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The Early History of Copper Fungicides
George Fiske Johnson

Fruit Marketing in the Okanagan Valley of British Columbia
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Translated by Esther Louise Larsen

News Notes and Comments

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THE EARLY HISTORY OF COPPER FUNGICIDES

It is now just fifty years since Professor A. Millardet of the Academy of Sciences at Bordeaux, France, first made public his famous discovery that a mixture (*bouillie*) of copper sulphate and lime was an effective control for one of the most destructive fungous diseases in France,—the downy mildew of grapes (*Peronospora viticola*).[1] His announcement climaxed two years of careful research and covered not only the nature of the new fungicide, but "the exact composition of the liquid to be used . . . together with instructions relative to both the mode of application and to the most favorable time for treatment." While his recommended mode of application, namely, using a heath broom dipped into a bucket or watering pot, has evolved into elaborate mechanical spraying devices, his recommended proportion of copper sulphate, lime, and water, popularly known as *Bordeaux mixture*,[2] has not been changed materially to this day.

[1] *Annales de la Société d'Agriculture de la Gironde*, April 1885, p. 73.

[2] The English translation of Alexis Millardet and L. U. Gayon, "Traitement du Mildiou par le Mélange de Sulfate de Cuivre et de Chaux," in the *Journal d'Agriculture Pratique* (Paris), Année 49 (2):707–710 (Nov. 12, 1885) as given in the U. S. Department of Agriculture, Division of Botany, *Bulletin 2*, p. 108 (Washington, 1886), uses the term "mixture of sulphate of copper and lime." Another English version is available in *The Discovery of Bordeaux Mixture*, a translation from the French by Felix John Schneiderhan with a biographical sketch and foreword by the translator (*Phytopathological Classics 3*. Ithaca, N. Y., American Phytopathological Society, 1933). The translation of the results of the extensive experiments by Millardet and David in 1886 in the U. S. Department of Agriculture, *Report*, 1886, p. 102, gives the name "copper mixture of Gironde." A circular published and widely distributed by the U. S. Department of Agriculture in May 1886 gives full details for making the fungicide but does not refer to it by a specific name. However, a footnote added when this circular was reprinted in the *Report* of the U. S. Department of Agriculture for 1886, p. 100, explained: "This is the copper mixture of Gironde, or Bordeaux mixture." The first use of the name "Bordeaux mixture" found by the present writer is in a letter by Gustave Foëx of the National School of Agriculture at Montpellier, France, to Professor C. V. Riley, United States Ethnologist, dated Nov. 30, 1886, and pertaining to the conclusions reached by an international congress on control of

Unfortunately, Millardet's discovery has been described as solely of accidental occurrence with the regrettable consequence that the history of copper as a fungicide before Millardet's time, as well as the circumstances surrounding his work, are practically unknown.[3]

The earliest known record of copper being used as a fungicide deals with the application of bluestone (copper sulphate) to kill smut spores on cereals. The disinfection of seeds by bluestone was first practiced with the cereals by Prevost of France as early as 1807, and improved by Dreisch in 1873 through the addition of a limewater bath to follow the bluestone.[4] It is also probable that copper sulphate was used early in the nineteenth century to control foot rot in sheep.[5]

The next important step was a discovery by Boucherie of France in 1838. He found that copper sulphate, in a solution of 1 part by weight to 100 parts by weight of water, could be used

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fungous diseases, held at Florence, Italy. Foëx listed Bordeaux mixture as one of the formulae of a copper salt that was "boldly proclaimed" by the congress. See the U. S. Department of Agriculture, *Report*, 1886, p. 102. It is obvious that the present name for the fungicide was first applied sometime between May and December 1886, and, in all probability, by the international congress in November of that year. Certainly, the name did not originate with Millardet since he did not use it in announcing his experiments of the year 1886.

[3] The following may be quoted as typical of the popular versions of this discovery, as given in most present-day treatises: "The history of the origin of this fungicide [Bordeaux mixture] is rather interesting in that it may be regarded as of accidental occurrence. The discovery that milk of lime, to which a copper salt had been added, possessed fungicidal properties was the result of an attempt on the part of certain vineyardists in the vicinity of Margaux, St. Julian, and Pauillac, France, to deter travellers in that region from molesting the fruit in the vineyards bordering the public highways. The salt of copper was added to the lime to give it the appearance of a poisonous compound. It was noted in 1882, during a severe epidemic of the downy mildew of the grape, that the foliage of the vines to which the above mixture had been applied remained green and healthy, while the leaves on adjacent vines not sprayed, or those that had received an application of milk of lime alone, were destroyed by the mildew. . . ." William Stuart, *The Potato*, 324 (Philadelphia, 1928).

[4] F. L. Stevens and J. G. Hall, *Diseases of Economic Plants*, 9 (New York, 1915).

[5] The earliest reference found by the present writer is an article in the *Farmers' Cabinet*, 4:240 (Mar. 16, 1840). It is reprinted from the *Maine Farmer* and covers the recommendation of blue vitriol for the control of foot rot of sheep.

effectively in the preservation of wood.[6] Boucherie's principle was widely adopted by French vineyardists in the preservation of grape stakes and remained a general practice as late as 1885.[7] As will be explained later, a direct relationship existed between this use of copper sulphate and the discovery of its great fungicidal properties since frequent observations had been made that the copper sulphate, washed from the stakes onto the vines, was serving as a control of downy mildew.

The first specific recommendation of a combination of copper sulphate and lime as a fungicide is that of Charles Morren, professor of agriculture at the University of Liége in 1845. It follows:

> The employment of lime and marine salt, mixed with a small quantity of the sulphate of copper, is, as I have said, of a recognized efficacy in the destruction of the germs of parasite plants [fungous diseases]; consequently, to powder with these mixed substances the soil which has been planted with sick potatoes, is an operation calculated to destroy the germ of the scourge, and cannot be too strongly recommended everywhere.[8]

This suggestion was prompted by an epidemic of late blight (*Phytophthora infestans*) on potatoes which had spread throughout America and Europe and was then causing a shortage of food and threatening famine in Ireland. Morren was one of the first to show that late potato blight was caused by a fungus, but unfortunately he stood practically alone in his conviction. His belief is described as "the single exception" to the general belief that the disease was caused by atmospheric conditions.[9] Morren never cited experiments or indicated that he had experimented with the chemical mixture he recommended. Only a slight stretch of the imagination is required, however, to realize how his suggestion, if widely accepted, might have soon led to the dusting

[6] E. E. R. Tratman, "Report on the Use of Metal Railroad Ties and on Preservative Processes and Metal Tie-Plates for Wooden Ties," in the U. S. Department of Agriculture, Division of Forestry, *Bulletin 9*, p. 269 (Washington, 1894).

[7] Prosper de Lafitte, "Action du Sulfate de Cuivre sur le Mildiou," in the *Journal d'Agriculture Pratique*, Année 49 (2):478–484 (Oct. 1, 1885).

[8] A letter in the Brussels *Independence*, Aug. 14, 1845, reprinted in the *Monthly Journal of Agriculture*, 1:389 (February 1846).

[9] *Monthly Journal of Agriculture*, 1:258 (November 1845).

of the potato plants with the mixture, and the evolution of a universally acceptable fungicide. It was apparently the refusal of the general public to grasp this new theory of plant diseases that accounted for his remedy being ignored and his name passing into obscurity when he might have become the greatest scientist of the age. The distinction that would have come to any scientist demonstrating a practical control for the late potato blight during Morren's time is indicated by the following statement of Edmund Burke, United States Commissioner of Patents:

> . . . We doubt, if in the whole history of vegetable production, there has ever been within the same time such an array of talent, and so great pains-taking, brought to bear upon any one of the fruits of the earth, as has been done with respect to this single affection of the potato plant. . . . Analyses the most accurate and minute; the keenest microscopic research; the application of every kind of test that human wisdom could suggest, have been resorted to; but if hope has now and then brightened at the seeming aspect of a discovery, the gloomy reality has again forced the confession, we were deceived, and the cause is still wholly hidden from us. Providence may indeed sometime hereafter unfold the mystery, but as yet it seems beyond the human ken to discern it. . . . There has never been we believe so universal, destructive and continued a loss of any substance employed as food. Its limits reach according to the accounts, from Australia in the eastern hemisphere to the West Indies, South America, and our own country in the western. The sustenance of millions has been as it were poisoned—famine and disease and death have followed in the train of the plague, that has swept like a blast over continents. Men's hearts have quailed and sunk within them at the cry of the starving who have pointed to fields yielding but sickening masses of putrefaction, and imploringly begged for something that might still the cravings of a raging appetite—humanity has wept to see the bleeding spirit bared and in anguish, while even the gathered contributions of multitudes, by the necessary subdivision has proved but a pittance by which to eke out a little longer the remnants of a wo[e]ful life. The potato disease—what words of dread to millions! What ghastly shapes of wretchedness and death start forth to speak of withered hopes and blasted expectations! And the end is not yet.[10]

American contemporaries of Morren in the advocacy of copper sulphate as a fungicide were Judge Cheever of New York and J. E. Teschemacher of Boston. Speaking as president of the New York Farmers' Club, Cheever made this significant statement on November 12, 1844:

[10] U. S. Commissioner of Patents, *Annual Report*, 1847, p. 140–141 (Washington, 1848).

> . . . Sulphate of copper is said to be a preventive of rust in grain. This disease [late blight of potato] is compared to rust. Cannot the science of chemistry throw some light upon the subject? In all this discussion, I see a brilliant proof of our want of an agricultural school, to which such questions of immense magnitude should be referred.[11]

At the very time that Cheever was making his New York speech, Teschemacher, a Boston chemist and horticulturist, was busy with his home-made microscope, observing the reaction of the late-potato-blight spores to chemicals.[12] He first experimented with common salt and found it so successful that he did not search further, although he did recommend that scientists who were so fortunate as to possess improved microscopes should experiment with "sulphate of iron, sulphate of soda, or of ammonia, or any other substance which can be cheaply applied. . . ."[13] In December 1844, he prepared a manuscript giving his explanation of late potato blight and his experiments with chemical salts as a control, and addressed it to the New York State Agricultural Society, but "no notice was ever taken of it"[14] and the manuscript was lost. Teschemacher first learned of copper sulphate in the English translation of Morren's paper which arrived at Boston on the steamer *Cambria* on or about December 8, 1845, and immediately he recommended the use of a "bluestone and lime solution" for treating the seed for the potato crop of 1846. Undoubtedly, the emphasis on applying the solution to the seed instead of to the growing plants detracted from the recommendations of both Morren and Teschemacher, and postponed the discovery and correct use of copper fungicides until the time of Millardet forty years later. However, W. F. Radclyffe, using copper sulphate on roses to control mildew in 1861, burned the foliage so severely that he did not experiment further with it.[15]

The desperation which confronted Europe as late as 1850 due to fungous diseases is shown very vividly by the prayer of the

[11] *Ibid.*, 1844, p. 232 (Washington, 1845).
[12] *Ibid.*, 231.
[13] *Ibid.*, 234.
[14] *Ibid.*, 1845, p. 514 (Washington, 1846).
[15] A. F. Mason, *Spraying, Dusting, and Fumigating of Plants*, 4 (New York, 1929).

bishop of Montpellier, France, written for use in all the churches of his diocese:

> We pray Thee, O Lord our God, that Thou wouldst deign to regard the vines with kindly eye and propitious countenance; and that Thou bestow upon them Thy blessing, that neither the terrible consequences of Thy wrath, nor any noxious disease devour them, but that unharmed and full of delight the fruit be conducted to a perfect maturity, and happily preserved for our use.[16]

To understand fully the developments in France between 1878, when the downy mildew first appeared, and 1885 when Millardet announced his copper sulphate and lime remedy, it is necessary to point out the relationship between certain copper compounds and the French wine industry during the nineteenth century. In addition to wine, a product of the industry was verdigris or basic copper acetate. It was prepared by piling sheets of copper with layers of fermenting husks of grapes, commonly called the marc of the wine press. The copper oxide, formed at the expense of the oxygen of the air, combined with the acetic acid furnished by the oxidation of the alcohol and gave the green salt known as *verdigris*.[17] Verdigris was, therefore, a common and inexpensive chemical, familiar to grape-growers throughout southern France. One of its unique uses was sprinkling it on grapevines near roads and railroads late in the season to discourage pilfering of the ripe fruit. Just when this was first practiced is not recorded but Prillieux, writing in 1885, stated:

> For a long time it has been the custom in certain parts of Médoc, especially in the vicinity of Margaux, St. Julian, and Pauillac, to sprinkle the vines that skirt the railroads [and highways] with milk of lime, to which is added a salt of copper. Verdigris was formerly employed for this purpose, but on account of economy, for several years past it has been replaced by sulphate of copper. The purpose of this operation is to prevent children and marauders from picking the ripe grapes. . . .[18]

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[16] Henri Erni, "The Grape Disease in Europe," in the U. S. Department of Agriculture, *Report*, 1865, p. 330 (Washington, 1866).

[17] C. L. Bloxam, *Blozam's Chemistry: Inorganic and Organic*, 619 (Philadelphia, 1883).

[18] Édouard Ernest Prillieux's Report to the Minister of Agriculture on the Treatment of Mildew in Médoc, Paris, Oct. 22, 1885, as translated in the U. S. Department of Agriculture, Division of Botany, *Bulletin 2*, p. 83 (Washington, 1886).

The reason for the increasing cost of verdigris between 1870 and 1885 and the substitution of the cheaper copper sulphate by the vineyardists was in all probability due to verdigris being essential in the manufacture of Paris green (copper acetoarsenite) which had been found about 1866 to be an effective insecticide.[19] By 1870 it was being generally recommended for the control of leaf-eating insects, and within a few years "hundreds of tons"[20] were sold for insecticide purposes in a single year. This great demand for Paris green gave verdigris an entirely new economic status and caused the French vineyardist to turn to the cheaper copper sulphate as the "scare crow" for marauders; this chemical, as previously explained, was also well known as a wood preservative during this period.

By the time the downy mildew reached France in 1878, copper sulphate was being used in mixtures with lime on grape vines along roadways in the Bordeaux section and throughout France as a preservative for grape stakes. This general utilization made inevitable the discovery of its properties as a fungicide because the greater the destruction caused by the downy mildew, the more obvious became the effect of the chemical on the vines near the sulphated stakes and on the treated vines by the roadways. The details of how such observations led to the perfection of the copper sulphate-lime treatment, not only at Bordeaux but in two other sections of France contemporaneously, show the result of logical, careful research which makes the discovery anything but "an accidental occurrence."

As soon as the downy mildew became destructive in the vine-

[19] Paris green, popular as a shutter paint, was first reported used to control Colorado potato beetles by Edwin Reynolds, crop correspondent of the U. S. Department of Agriculture at Fond du Lac, Wis. He wrote: ". . . July 5, [1868] . . . I was told by a farmer from Iowa that one pound [of] Paris green and four pounds [of] dry ashes sifted and well mixed, applied to the infested vines while the dew was on, was sure death to the bugs and no injury to the vines." U. S. Department of Agriculture, *Report*, 1868, p. 433 (Washington, 1869). The remedy had been used in Iowa at least the previous year, and probably also in 1866 when the beetle was reported extremely destructive. U. S. Department of Agriculture, *Report*, 1871, p. 74 (Washington, 1872).

[20] C. V. Riley, in the U. S. Department of Agriculture, *Report*, 1884, p. 327 (Washington, 1885).

yards near Bordeaux, Millardet began his study to discover the "weak point" in the development of the fungus. In working with the summer spores, he found to his amazement that they would not develop in water taken from his well but "when sown in the city water, in dew, rain-water, or distilled water, they continued their evolution uninterruptedly."[21] He was aware of the fact that his well water was "heavily charged with calcareous salts" and consequently reasoned that the spores were easily killed if the right chemicals were used. He concluded after several years study that "a practical treatment of the mildew should aim not to kill the parasite in the leaves . . . , but to forestall its development by preventively covering the surface of the leaves with various substances capable of depriving the spores of their vitality, or at least of hindering their germination." He had reached this point in his research and was "seeking a substance that would serve the purpose" when he made his roadside observations which are described here in his own words:

> At the close of October, 1882, I had occasion to pass through the vineyard of St. Julian, in Médoc. All along the road I followed, I was not a little surprised to see that the vines still bore leaves, while everywhere else they had long since fallen. There had been mildew there that year, and my first impulse was to attribute the persistence of the leaves along the way to some treatment which had preserved them from the disease. In fact, examination enabled me to ascertain at once that these leaves were covered, in great part, on the upper surface, with a thin, adherent layer of a bluish-white, pulverulent substance.
>
> Arriving at the château Beaucaillou, I questioned the steward, M. Ernest David, who told me that the custom in Médoc is to cover the leaves, at the turning of the grapes, with verdigris or sulphate of copper mixed with lime, to keep off marauders.[22]

Ernest David disagreed with Millardet at first, but Millardet apparently soon convinced him (probably by relating the experiments with the well water) that the idea was at least worth further investigation. Consequently, Millardet conducted experiments

[21] Millardet and Gayon as translated in the U. S. Department of Agriculture, Division of Botany, *Bulletin 2*, p. 108 (Washington, 1886).

[22] Alexis Millardet, "Traitement du Mildiou et du Rot," in the *Journal d' Agriculture Pratique*, Année 49 (2):513–516 (Oct. 8, 1885), as translated in the U. S. Department of Agriculture, Division of Botany, *Bulletin 2*, p. 94 (Washington, 1886).

with "various salts of copper (the sulphate, carbonate, phosphate, and sulphuret), and the corresponding salts of iron, . . . lime in powder or mixed with water. . . . [and] mixtures . . . with varying proportions of the sulphate of copper and lime" in his garden in 1883, and David repeated the experiments in the vineyard at Médoc. In addition, Millardet secured the able assistance of Gayon, professor of chemistry at Bordeaux, and through his help was able to determine that "the limit of concentration incompatible with the complete development of the reproductive germs [spores of downy mildew] is—For lime, a solution of 1 to 10,000. For sulphate of iron, 1 to 100,000. For sulphate of copper, a solution of 2 or 3 to 10,000,000." This led to the discovery of the spore-killing property of the water in Millardet's well. "This well", he reports, "is 11 meters deep, and the water is raised by means of an old copper pump. An analysis of the water showed 5 milligrams of copper per liter, or more than ten times as much as is necessary to kill the reproductive germs of the *Peronospora*."

The experiments in 1883 were sufficiently convincing to both Millardet and David to cause them to continue the work on an even more extensive scale in 1884, when, unfortunately, the mildew was very light and the results of the experiments could not be fully determined. There was sufficient evidence, however, to "ascertain that of all the substances employed the mixture of sulphate of copper and of lime was the one which produced the best results." Millardet was then placed in a perplexing situation. Should he keep his treatment secret for further testing the next year when the disease might be more severe, or should he take a chance on a public announcement and recommendation even though he did not feel that his trials were completed? "Nevertheless," he records, "as a certain report was noised abroad of the sulphate of copper treatment, I decided to communicate to the Agricultural Society of Gironde, the results obtained."[23] Following this communication, eight large estates in the Bordeaux district applied the treatment to several hundred thousand vines in 1885.

[23] *Annales de la Société d'Agriculture de la Gironde*, April 1885, p. 73.

How inevitable the discovery of the copper sulphate-lime treatment really was, is indicated by the work in progress in other sections of France contemporaneous with that of Millardet. Perrey communicated observations to the Academy of Sciences in Paris on September 25, 1884, which, as he explained, "proved the destructive action of sulphate of copper on the mildew." A year later he also wrote:

> . . . After having shown the immunity procured to young plants by dipping stakes into a copper solution, I took exception to the practical value of this mode of preserving the vine, which is neither applicable to vines not staked, nor sufficient for the protection of those with large arborescence, and is in all cases quite costly. By experiment, I have this year [1885] found a method of employing the copper salt which has made its efficacy certain, and permits of its economical employment in all cultivated fields. It consists, by the aid of a spraying machine, in spreading upon the upper surface of the leaves, in the form of a vapor, a solution of crystallized sulphate of copper, 5 parts to 100.[24]

Prosper de Lafitte reported extensive experiments with sulphated stakes as a control for mildew in Saône-et-Loire and Lot-et-Garonne in 1884 and 1885, and records the fact that scientists and agricultural authorities came from different parts of France to see the results which were most striking.[25]

Vergnette-Lamotte, in a communication to the Commissioner of Agriculture of Beaune on October 31, 1885, made public for the first time the noteworthy work of another Frenchman, Louis Podechard, in perfecting a copper sulphate-lime dust. His communication reads:

> In the first days of October [1885], on the plains of Beaune [some three hundred miles from Bordeaux], I ran across three small plots of vines which, in the midst of a vineyard entirely stripped of its leaves, presented the most rich and luxuriant vegetation. . . . These plots belonged to a vine-dresser of the halmet of Gigny, who, in the month of August, had treated them with a powder of his own invention, made in the winter of 1884–'85 [undoubtedly without any knowledge of Millardet's work]. . . . Knowing the action of sulphated stakes on mildewed

[24] A. Perrey, "Sur la destruction du mildew par le sulfate du cuivre," in the *Comptes Rendus des Séances de l'Académie des Sciences* (Paris), 101:659–662 (Oct. 5, 1885) as translated in the U. S. Department of Agriculture, Division of Botany, *Bulletin 2*, p. 89 (Washington, 1886). In Millardet's experiments of the following year this remedy burned the leaves severely and was discontinued.

[25] Prosper de Lafitte, "Action du Sulfate de Cuivre sur le Mildiou," in the *Journal d'Agriculture Pratique*, Année 49 (2):478–484 (Oct. 1, 1885).

vines, it occurred to this vine-dresser, Louis Podechard, to treat his vines with quicklime, slaked by means of a solution of sulphate of copper.[26]

The unique method used by Podechard was to pile wood ashes in the form of a circle on his barn floor, and within the circle of ashes to place the quicklime. The copper sulphate solution was then added and the lime slaked without the solution running all over his floor. The resulting material including the ashes was then mixed, dried, and pulverized. With the use of a "sulphuring box", in common use in France for thirty years as a means of applying sulphur to control powdery mildew (*Uncinula americana*), Podechard's mixture was applied in the form of "a thick cloud of dust".

While Millardet must be credited with the discovery of Bordeaux mixture, it should be noted that his work before 1886 dealt entirely with the *bouillie* form and that Podechard is entitled to the credit for originating and providing a practical method for making the copper sulphate-lime treatment in powdered form.

In a circular distributed throughout the United States in May 1886, to three thousand parties "thought most likely to be interested", Norman J. Colman, United States Commissioner of Agriculture, listed five remedies for downy mildew which gave satisfactory results in France and were considered "worthy of trial in this country."[27] These were, in brief: sulphating the grape stakes and spraying the vines with a copper sulphate solution "as soon as the leaves are fully formed"; spraying lime and water (whitewash) on the plants; using Millardet's recommendation of a solution of copper sulphate and lime (not referred to by specific name at that time); dusting with "The powder of Mr. Podechard"; and using milk-kerosene emulsion adding carbolic acid and glycerine.

In the meantime, Millardet did not abandon his research. The flood of suggestions of remedies which cropped up all over France during 1885 led him to continue his trials in 1886. During that

[26] Gérard Elisabeth Alfred de Vergnette-Lamotte, as translated with the title "A Remedy for the Mildew," in the U. S. Department of Agriculture, Division of Botany, *Bulletin 2*, p. 80 (Washington, 1886).

[27] U. S. Department of Agriculture, *Report*, 1886, p. 99 (Washington, 1887).

year, he studied the effects of eighteen remedial mixtures in both dry and fluid form. Briefly, his results indicated that a solution of copper sulphate alone, varying from ½ percent to 4 percent, burned the leaves severely and was only partially effective as a control; that milk of lime was ineffective; and that the sulphate of copper and lime in powdered form was as effective as a *bouillie*.[28]

The first experiments with copper fungicides by the United States Department of Agriculture were planned in 1887 and several of the State experiment stations undertook extensive experiments from 1888 to 1890. It had been generally known that an effective control for the downy mildew of grapes would, in all probability, prove effective for somewhat similar diseases of tomatoes and potatoes. Tomatoes were sprayed with Bordeaux mixture by M. D. Jouet, near St. Julian, France, in 1885 with "good results." In 1886, the United States Department of Agriculture suggested: "It is thought that something may be done to check the rot [caused by late blight of potatoes] by the careful use of fungicides. As soon as brown or black specks begin to appear upon the vines they may be dusted with Podechard powder, which treatment should be repeated as often as necessary."[29] In other words, the first recommendation for the control of late blight of potatoes in the United States related to dusting with copper sulphate-lime powder as originated by Podechard, and not to spraying with the mixture as devised by Millardet which is now so widely practiced. Beginning in 1889, the Vermont Agricultural Experiment Station used Bordeaux mixture upon all of its regular potato fields and published the fact that late potato blight could be effectively controlled with this fungicide.[30]

The final chapter in the early history of copper fungicides was the work of practical-minded Clarence M. Weed, entomologist and botanist of the Ohio Agricultural Experiment Station, who, in 1889, conclusively demonstrated that an arsenical insecticide such as London purple could be successfully added to Bordeaux mix-

[28] *Ibid.*, 102.

[29] *Ibid.*, 124.

[30] "Plant Diseases," Vermont Agricultural Experiment Station *Bulletin 28*, p. 17 (Burlington, 1892).

ture and thereby control leaf-eating insects as well as fungous diseases.[31] This discovery opened the way for making plant-insect-and-disease control a practical farm operation and concluded one of the greatest contributions of science to agriculture during the nineteenth century.

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[31] "Notes on Experiments with Remedies for Certain Plant Diseases," in the Ohio Agricultural Experiment Station *Bulletin* (ser. 2) 2 (7):186 (Columbus, 1890).

FRUIT MARKETING IN THE OKANAGAN VALLEY OF BRITISH COLUMBIA[1]

The Okanagan Valley of British Columbia is bounded on the east by the Gold Range Mountains, and on the west by the Cascades. It includes all the land drained by streams flowing into Okanagan Lake and Okanagan River north of the International Boundary Line, and therefore extends from the forty-ninth parallel northward to the city of Armstrong where a height of land divides the watersheds of the Columbia and Fraser rivers. As the exact boundaries of Okanagan Valley have never been defined, the name is also applied to the land due north of Armstrong towards Sicamous which is drained by the Spallumcheen River, and the region southwest of Penticton which is watered by the Similkameen River. As the conditions prevailing in these two smaller valleys are similar to those in the larger one, and as the districts are not separated from one another by natural barriers, the term Okanagan Valley as used in this study includes this entire area. Thus defined, the Okanagan Valley of British Columbia includes 12,800 square miles of land, being approximately 160 miles long and 80 miles wide.[2]

The central theme of the agricultural history of the Okanagan Valley is the trial-and-error experimentation to find the crops and methods of cultivation and marketing best suited to its physical conditions and resources.[3] From the appearance of the first fur trader to the time of the modern fruit grower, the Valley has exemplified the principle that the factors which determine

[1] This article is based on material in ch. 6 of the author's M.A. thesis, "A Study of the Okanagan Valley of British Columbia" (University of British Columbia, 1931).

[2] See *ibid.*, ch. 1, Nature's Gift to the Okanagan Valley, for a detailed statement of the geography of the Okanagan Valley.

[3] *Ibid.*, ch. 2, The Fur Trader's Contribution; ch. 3, The Gold Miner's Contribution; ch. 4, The Cattle Rancher; ch. 5, The Wheat Grower.

the occupation of the inhabitants of any distinct region are geographical factors as tempered by economic outlet.

Fruit growing in the Okanagan Valley began in the seventies when the early farmers planted a few trees around their houses to supply food. Thomas Ellis set out trees on his ranch at Penticton in 1874, and George Whelan and Alfred Postill started small orchards at Kelowna in 1875 and 1876. Soon nearly every farmer had a small plot with two or three different varieties of fruit trees.

It was not, however, until 1892 that commercial plantings were made. In that year 200 acres on each of Lord Aberdeen's ranches, the Guisachan at Kelowna and the Coldstream at Vernon, were planted.[4] This was a turning point in the history of the Valley, for it marked the first step toward fruit production on a large scale. Other men then started to plant large orchards. At Vernon, the Brookside orchard on the B. X. Ranch owned by Frank Barnard was divided into about a dozen 40-acre lots and sold to individual purchasers. At Kelowna, George Rose, Eli LeQuime, Thomas Ellis, A. B. Knox, and the Mission fathers[5] had flourishing orchards by the early nineties, and in 1895 the Bankhead Orchards were planted by T. W. Stirling. In 1902, R. Long also started a commercial enterprise. Two years later, W. C. Ricardo, manager for Lord Aberdeen, irrigated and subdivided 700 acres at the west end of the Coldstream Ranch. In

[4] Cf. Countess of Aberdeen, *Through Canada with a Kodak*, 191 (Edinburgh, 1893). "Two hundred acres of the Guisachan farm will be planted with various kinds of fruit-trees this year, and with the smaller kinds of fruit, such as strawberries, raspberries, blackberries, currants, and gooseberries in between. All these fruits, as well as the apples, pears, plums, melons, &c., flourish magnificently with the best possible results." The fruit trees, however, lived only four years, as they were not taken care of properly. This ranch was bought in 1891 from the Postills and later sold to Price Ellison of Vernon.

The Coldstream Ranch was purchased from the Vernon brothers in 1891, and consisted of 13,000 acres. In 1906, Lord Aberdeen formed the estate into a limited liability company, the shares of which were held principally by himself and James Buchanan of Petworth, Sussex. About 1908, there were 700 acres in fruit. During the World War, the entire estate was purchased by Sir James Buchanan (now Lord Woolavington), and it is now owned by his daughter, the Hon. Catherine Buchanan-McDonald.

[5] *Ibid.*, 184.

1906 the benches at Kelowna and the hillsides at Vernon were planted, and from that time onward the fruit acreage in the Valley increased rapidly.

There were also early attempts to raise fruit in the Spallumcheen Valley, but it was soon found that the winter injuries killed the trees. Development in the Similkameen Valley was retarded by the extreme summer heat and the lack of irrigation. So the fruit industry was gradually localized in the Okanagan Valley proper, and was particularly successful in the region between Vernon and Penticton.

The interest of the Governor-General in the industry and the striking success in similar valleys in Washington and Oregon gave fruit growing in the Okanagan Valley a great impetus. The phenomenal production in the Washington and Oregon fruit districts led people to believe that the climatic and physical conditions of the Okanagan Valley were equally favorable. Profitable prices were realized in the nineties, for the industry in Eastern Canada had received a severe set-back during the depression. Finally, the newly formed land companies extolled the attractions of fruit ranching in the Okanagan Valley, and the prosperity that awaited all who should follow in Lord Aberdeen's footsteps.

Bearing these factors in mind, it is little wonder that in the twelve years from 1901 to 1913 the number of trees in the Valley increased 525 percent. At the end of that time there were about thirty thousand people dependent on the fruit crop.[6] As many of the growers were inexperienced and lacked knowledge of how to plant and care for their orchards, many of the trees were of unsuitable varieties and were planted in undesirable locations and on poor land.

In order to overcome the poor start, the Provincial Department of Agriculture sent R. H. Palmer, Thomas Cunningham, and others to investigate conditions and advise the farmers through farmers' institutes as to the best methods of growing and market-

[6] *Report of the Okanagan United Growers*, 21 (Vernon, 1918). *Report of the Minister of Lands for the Province of British Columbia for . . .* 1913, p. 97 (Victoria, 1914).

ing apples. These men advocated the practices followed in the Hood River Valley of Oregon, where the apples had won world fame. They maintained that the quality of the Okanagan apple was more important than the quantity produced, and that high standards must be adopted. At the same time, steps were taken to keep the orchards free from harmful insects. Thomas Earle of Lytton took a leading part in advising the Government in this work, and soon very stringent regulations were brought into force, especially against such devastating pests as the San Jose scale and the codling moth. The action of the Government was prompt and successful.

Conditions were also improved by the growers themselves. Between 1912 and 1914 tree planting stopped altogether, and many orchards on unsuitable land went out of bearing. During the war years, the number of trees remained stationary, but after 1920, more of the suitable varieties were planted. By 1921, the acreage in fruit trees in the Okanagan Valley as compared with 1901 had increased 674 percent.[7]

The history of the fruit industry of the Valley falls into two distinct periods with 1921 as the dividing line. Before that date the average annual production of apples in British Columbia was 1,500,000 boxes, but afterward it rose to 3,156,000 boxes.[8] During the first period the problems incident to the growing of fruit were being grappled with, and in the second, the problems of marketing the surplus production. The former, therefore, contributed solutions to questions which were of local importance, while the latter evolved forms of organization applicable in the marketing of any commodity. The second period is considered in detail here, as problems arising out of the marketing of surplus production are common to all industries.

As early as the nineties the Okanagan farmers, finding that they were growing more fruit than could be consumed locally, began to ship a certain amount of their produce to the Prairie Provinces.

[7] K. P. Caple, "The British Columbia Apple Industry," 5 (MS. Univ. B. C., 1927).

[8] W. Sanford Evans, in his *Report of the Royal Commission Investigating the Fruit Industry*, part 2, p. 10 (Victoria, 1931).

They were soon barred from Manitoba because the Ontario orchardists had an advantage in shipping their fruit at low rates across the Great Lakes. An export trade from British Columbia was started in 1903 when Messrs. Stirling & Pitcairn of Kelowna shipped a carload of apples to Great Britain. Because of the long voyage and the heavy cost of transportation this market was not developed as fully as that of the Prairie Provinces, the logical outlet for Okanagan apples as practically no fruit was produced there. As a consumer, it proved adequate until 1912, for until that time there was little competition from Ontario, Nova Scotia, and Washington. Then, however, an unusually bountiful crop in Washington and Oregon coincided with a large increase in yield in British Columbia. The usual markets in the cities were glutted, and the entire Canadian Northwest was flooded with low-priced fruit. This was the first general check experienced by the fruit industry of the Okanagan Valley, and the fruit grower was so incapable of adapting himself to the new marketing conditions that, after five years, he found himself hopelessly in debt. He had expended his entire capital in buying land and in caring for the trees during pre-bearing years.

The disaster of 1912 revealed to the fruit growers of Washington and Oregon the necessity of some form of cooperative selling agency to preserve the markets from demoralization during periods of stress. The Okanagan growers also needed means of effecting a more economical sharing of the nearby markets. They had already tried one cooperative organization, the Okanagan Fruit Union, formed in 1908, with its head office at Vernon and branch offices at Coldstream, Peachland, Summerland, and Penticton, but they were so unversed in the benefits to be derived from mutual assistance that petty jealousies led to failure. This organization had not checked the local competition for markets but had concentrated on the Prairie market. The result was that the growers remained at the mercy of shippers who took only the amount of fruit for which they had orders.

With the fall in apple prices in 1912, the necessity of uniting the growers in one selling organization became more and more apparent. As there was no source of capital to finance the

undertaking, W. C. Ricardo approached R. R. Robertson of the brokerage firm of Robertson & Morris of Vancouver. Impressed with the hardships of the fruit growers, Robertson went to Victoria to interview the Government in an attempt to obtain assistance. The latter deemed it advisable to make a survey of the situation and sent him on the mission. He aroused enthusiasm as he travelled from place to place, and the growers finally formed the Okanagan United Growers, Limited, in May 1913. It was a cooperative, non-stock, non-profit, central selling and distributing agency. The Government agreed to advance up to 80 percent of the subscribed capital, payable within twenty years, with interest at the yearly rate of 4 percent. The head office at Vernon was the selling and buying agent for nine affiliated local associations which did the assembling and packing at various points in the Valley. The capital consisted of twenty-eight shares of the nominal value of one dollar each, owned by the locals for voting purposes only. The working capital was secured by deducting 2 percent of the selling price from the growers' returns, for which the central issued bearer bonds carrying interest at 5 percent, repayable in five years. The organization was supported by certain fixed charges on all packages handled. All sales, over certain periods fixed by the association, were pooled, advances being made where desired up to a certain percentage of the estimated value of the produce to be delivered. About eleven hundred growers signed the three-party contract which called for the delivery of produce to the association for sale by the central. The contract was also continuous, subject to cancellation on March 31 of each year.

As a result of this cooperative movement British Columbia had almost complete control of the Prairie market by 1923, supplying 82 percent of the apples consumed on the Prairies, whereas it had shipped only 39 percent in 1915, 31 percent coming from Eastern Canada, and 30 percent from foreign countries, chiefly the United States.[9] Of the remainder, 9 percent came from Eastern Canada and 9 percent from foreign points.[10] Two com-

[9] Caple, "The British Columbia Apple Industry," 28.
[10] *Ibid.*, 30.

petitors had given place to British Columbia. Over the ten-year period, 1915–1925, 46.7 percent of the total apple production of the Okanagan Valley was consumed on the Prairies.[11]

This market was important not only because it was close and the cost of transportation low, but also because it was protected from American dumping by a tariff of thirty-three cents on every box of apples. As a result, the selling price in the Prairie market was higher than the world price. However, it could only be kept at that level so long as the market was not flooded and the demand was greater than the available supply. Therein lay the difficulty.

As the Okanagan apple acreage increased, the extra production was unloaded in Alberta and Saskatchewan. Moreover, there were so many independent shippers in the Valley that it was absolutely impossible to control the markets. Due to increased production in 1921–22 and lack of cooperation among the shippers, the Okanagan United Growers was forced to ship a total of 1,287 cars of winter apples,—115 to Eastern Canada, 529 to the United States, and 319 to Great Britain, but only 324 to the Prairies which had always been its chief market.[12] As might have been expected, the returns to the growers were lower than they had ever been before. At the end of the season, many of the growers received no net cash returns, and were billed for their proportion of the costs. The selling prices were at rock-bottom, and it was realized that something had to be done to improve conditions. During the winter of 1922–23, Dr. Theodore Macklin, professor of agricultural economics at the University of Wisconsin, and Mr. Aaron Sapiro of California were brought to the Valley to lecture on successful methods of coöperation. Their meetings were attended by large numbers of growers who became convinced that effective coöperation must be secured.

As a result of this campaign the Associated Growers of British Columbia, Limited, was organized in the spring of 1923. It immediately took over the leading shipping houses and amalgamated them with the coöperative packing houses. At the same

[11] *Ibid.*, 39.
[12] *Ibid.*, 62.

time, the organization obtained contracts securing control of 80 percent of the apple production for five years. When it reached this tonnage, the Okanagan United Growers voluntarily went out of existence. About twenty-seven hundred growers signed a contract with practically the same terms as that of the old organization. The crops were to be delivered by the grower to the local association for packing, while the Associated Growers did the selling. At the end of the five-year period, a yearly contract went into effect for the Associated Growers, and since then the percentage of tonnage has considerably decreased to the advantage of the independent shippers.

The increasing number of shippers resulted in a partial return to conditions as they were before the formation of the Associated Growers. Instead of a proportional sharing of the Prairie market which would have resulted in a fair share of profits to all, the internal competition resulted in demoralization of this market and the forcing down of the selling price to the level of world prices. Thus, no benefit was realized from the tariff, and prices fell until it was necessary to place a check on the activities of the independent shippers.

To relieve conditions the Provincial Government passed in 1927 the Produce Marketing Act which created the Committee of Direction. This body consisted of three members, the chairman being appointed by the Government, and the other two by the British Columbia Fruit Growers' and Shippers' Federation, an organization composed of the Associated Growers and most of the independents. All shippers were required to obtain licences from the Committee to ship, and it was then the Committee's duty to set a minimum price at which the products might be sold on the Dominion market, but not on the export market. Below this price a shipper could not sell, although he might sell for a higher price.

The Committee also had the power to state the prices and terms on which the products might be marketed and delivered; to fix the quantity of any product or the proportion of the supply to be marketed; and to name the places from which the product might be delivered. It might also hold an inquiry and compel

the attendance of witnesses and the inspection of books. Finally, there were representatives in the principal markets who reported on the shipments arriving in their territory and kept the Committee advised daily of shipments from other centers, and of quotations received on their markets from other concerns.

The Committee was successful in stopping underbidding on the Prairie market and forcing down the price level to the lowest quotation, but it failed to gain control of the market and to supply the products in proportion to the demand of the consuming public. The independent shippers were able to get all their products on the preferred market, and the Associated found itself saddled with the whole surplus, which had to be shipped to Eastern Canada, the United States, and other distant and uncertain markets, where success was checked by the fact that the Annapolis Valley had an advantage in its proximity. Moreover, the competition for the Prairie market from the American growers until the levying of the 1930 tariff was so harmful that the Committee of Direction had to quote prices below the cost of production in order to enable the Okanagan fruit growers to compete.[13]

In 1930, the Committee devised a method of equalizing the returns received by coöperative and independent fruit growers. It had already taken the making of quotations and the control of distribution out of the hands of the shippers. Now it insisted upon compulsory price pooling, an arrangement by which the returns for each grower were determined by the prices received during the selling season on all markets. This procedure made for a fairer distribution of selling prices.

Because of the new tariff and the new method of price pooling, the growers would have been in a better financial position after the disposal of the crop of 1930 if the conditions on the Prairies had not been so poor. Being a one-crop area, there is a decided relationship between the purchasing power of the wheat farmers and the value of the fruit purchased. For this reason, the prices received by the Okanagan fruit growers were once more unsatisfactory, and dissatisfaction with the existing marketing

[13] During August 1930, a duty of half a cent a pound (about twenty cents a box) was levied on American apples coming into Canada.

system again appeared. The number of independents had increased and the grower-shipper was a new element in the industry.[14] Throughout the Valley there was a general feeling that the Produce Marketing Act was based on wrong principles and that it was contrary to economic forces to attempt to control prices and dominate the markets. Some growers maintained that price fixing resulted only in artificial and temporary bolstering of the industry, but others feared that the abrogation of the Act would result in a return to the conditions of 1922. Events in the next few years proved that these fears were well founded.

In the spring of 1931, the Supreme Court of Canada declared the Produce Marketing Act unconstitutional. Henceforth the Government of British Columbia could not interfere with interprovincial trading or exact levies for the purpose of controlling the marketing of produce. Many growers were of the opinion that a central selling agency was the only solution to the marketing problem, but the plans to introduce legislation providing for the compulsory coöperation of growers in the Provincial Parliament now had to be abandoned.

Mr. F. M. Black, chairman of the Committee of Direction, who fostered the central-selling plan, had advocated that all packing and selling organizations, including the Associated Growers, be reduced to the status of packing houses. All sales were to be made through the central agency which would have its branches in the large cities in western Canada, and could deal through the existing wholesale channels, replacing the brokerage houses. Mr. Black estimated that this plan would reduce the cost of marketing fruit from $700,000 to $300,000, making a saving of nine cents per package, an item which he claimed would pay twice over all the relief that could be had in the matter of irrigation charges.[15]

The independents, being individualists, and upholding the right

[14] Fixed charges by the Associated Growers during the first years of its operation to offset the cost of packing houses, storage plants, etc., resulted in lower returns to the growers and a consequent increase in the number of independents and grower-shippers.

[15] F. M. Black, "Plan of Central Selling," in the Vernon (B. C.) *News*, Nov. 13, 1930.

of each man to dispose of his fruit in the manner which pleased him best, opposed the central-selling plan. They took refuge behind the recommendations made by W. Sanford Evans, the Royal Commissioner investigating the fruit industry, who, after two years spent studying conditions in the Valley, suddenly expressed himself as adverse to any form of cooperation and in favor of a return to the conditions of open and unrestrained competition,—to use his words, the "firm establishment of self-government within the industry."[16]

The arguments against centralization in the Commissioner's report were based on the apparently sincere belief that the Okanagan fruit grower could reduce his cost of production by increasing the production of apples per acre from the present average of 250 boxes to 450, the average of the Wenatchee orchards. He maintained that the Okanagan farms were not run economically, but he did not take into consideration the fact that the fruit valleys of Washington have a comparative advantage over the Okanagan Valley. Their climate is milder; there are larger areas available in the fruit belts; and there is abundant water for irrigation. The Okanagan Valley has fewer advantages in these respects, and it is manifestly impossible to raise its production as high as that of the American districts. The territory south of Penticton has a comparative advantage over the rest of the Valley in the production of apples, but it is also one of the few places in Canada where cantaloups, peaches, and apricots grow. Therefore, this land is devoted to the culture of these fruits, and apple farming is forced on to the high-priced land in the north, where the possible production per acre is less because of climatic conditions.

The only recommendation with regard to marketing made by Mr. Evans was that the Okanagan Valley should concentrate on supplying twice the present number of export markets. No mention was made of the fact that the Valley should be "the orchard of the plains," and no consideration was taken of the likelihood of a decrease in American competition for the domestic market so long as the tariff remained in force. Instead, the

[16] *Report of the Royal Commission Investigating the Fruit Industry*, part 2, p. 28.

shippers were advised to hold their produce in cold storage so that the export market might be supplied with apples during the spring months. Many growers have pointed out that there is a demand for apples only during the winter, since the foreign market can obtain fresh tropical fruit in the spring, and that the cost of constructing more storage facilities and of shipping fruit in small quantities to many different places would greatly decrease the fruit-growers' profits.

The only form of cooperation approved by the Commissioner was "an association of shippers for the exclusive purpose of reporting and exchanging prices and terms and holding occasional conferences on these matters."[17] After the abolition of the Committee of Direction, this was the only stabilizing force in existence during the selling season of 1931. Between 80 and 90 percent of the shippers supported the formation of a Shippers' Council which was assisted by a Bureau of Information established by the Government to publish daily reports of all sales. Once again market control was not achieved. Little could be accomplished owing to the absence of complete cooperation and the Council's lack of legal authority to control the action of members who refused to abide by its decisions. At the end of the season, it was found that over 800 cars of fruits and vegetables of which the Council had no record had left the Valley.[18]

In 1932 the Okanagan Valley produced the largest crop in its history, and the prospect of uncontrolled shipments and a consignment deal was imminent. Not until late in the season did 90 percent of the shippers agree to form a shippers' cartel, an organization which, it was hoped, could provide for the proportional sharing of the domestic and export markets,—the agreed proportion of each shipper's tonnage to be sold on the domestic market being 40 percent. In an attempt to prevent debasement, the cartel named prices which it thought should be considered the minimum. But no penalties were provided for violation of rules, and the established shipping dates, prices, and marketing regula-

[17] *Ibid.*, 27.

[18] "Annual Report of the President of the British Columbia Fruit Growers' Association," in the Vernon (B. C.) *News*, Feb. 2, 1933.

tions were disregarded by signatories and non-signatories of the agreement. Internal competition and improper distribution were as great bête-noires as ever.

The debacle was not far distant. In the autumn of 1933 it was apparent that the Okanagan Valley was once more to have a bounteous fruit crop, and that it must dispose of some 3,500,000 boxes of apples. When the season was well advanced and the shippers had still failed to agree on an efficient marketing scheme and were selling apples at ruinous prices, the growers became incensed and raised the cry of "a cent a pound or on the ground."[19] Steps were taken to form the Okanagan Stabilization Board, and by tactics, later proved to have been of an intimidating nature in some cases, all of the fifty-two fruit shippers in the Valley were forced to become members of the Board, on which growers had equal representation with them. To implement the strict observance of the agreement, growers formed vigilance committees at various centers, and on occasion picketed carloads of fruit which they had reason to believe were not being sold in accordance with specified conditions.

The Okanagan Stabilization Board, embodying the most salient points of the Black plan of central selling, functioned with some success. Compulsory cooperation of growers and shippers was obtained, and sales were made over one desk, a levy of half a cent a box being made to defray expenses. Instead of receiving "red ink" for their apples, growers in most cases obtained the minimum sought, although certain varieties were sacrificed. It has been estimated that the slogan used in the campaign brought a million dollars more into the Valley than would otherwise have been the case.[20]

The Stabilization Board was, however, short-lived. One of the shipping houses refused to pay the equalization fees imposed,

[19] A net price to the growers of 40 cents a box. Cf. F. M. Clement, in the *Report on the Enquiry Conducted on Behalf of the Six Locals of the Associated Growers*, 3 (1933). "This [cost of production for 80 percent of the growers] would be a net price of about 75 cents per box to the apple grower. . . . I consider such a figure low enough."

[20] W. E. Haskins, president of the British Columbia Fruit Growers' Association, in *Country Life in British Columbia*, May 1934, p. 5.

and legal action was taken by the Board to collect the sum. The suit was dismissed by the Supreme Court of British Columbia on the ground that the agreement was illegal and unenforceable because it was in restraint of trade and contravened the Criminal Code. The judge added these words: "It is only fair to the growers' cent-a-pound organization to say that I am convinced they acted as they did in no spirit of wanton lawlessness. . . . Their actions originated in their firm conviction that market control is in a financial sense a matter of life and death with them."[21]

Apart from market control through the united action of the growers, the producers effected certain improvements in the distributive machinery of the industry. Following the publication of the Duncan Report in 1925 which revealed certain allegedly dishonest practices among middlemen,[22] the Associated Growers became convinced that the principle of the jobber-controlled broker was not in the interest of the growers and organized the Canadian Fruit Distributors, Limited, which absorbed a former brokerage company. The powerful group of Nash wholesale houses had its own brokerage organizations, the chief of which, after the publication of the Report, was taken over by the C. H. Robinson Company, Limited, which claimed to be separate from Nash influence. To meet competition from the latter, it was arranged that 75 percent of the net profits from the operation of the Canadian Fruit Distributors should be rebated to all wholesale houses buying through it.[23] In order to make a profit from the business, both organizations had to handle American and foreign lines of goods, and ceased to be brokers for British Columbia products exclusively. The Okanagan fruit shipper

[21] Mr. Justice Murphy's remarks, quoted in the Vernon (B. C.) *News*, Mar. 22, 1934.

[22] "Investigation into the Alleged Combine in the Distribution of Fruits and Vegetables," *Interim Report of the Commissioner*, Feb. 18, 1925.

[23] ". . . it seems there has been a system of special rebates, allowances and other iniquitous arrangements built up in the distribution of British Columbia fruits and vegetables. Such a system makes it difficult for any shipper to obtain support without adopting a very generous attitude in this respect." F. M. Clement, in the *Report on the Enquiry Conducted on Behalf of the Six Locals of the Associated Growers*, 2.

therefore became dependent for the distribution of his fruit on the goodwill of organizations which controlled 70 percent of the distributive facilities on the Prairies. Until 1933, brokers received a commission of twenty-five dollars on every car of Okanagan apples which they sold, but the growers' organization finally succeeded in obtaining a substantial reduction.

In 1931, one of the jobbing concerns on the Prairies, allegedly believing that it had not received from the Associated Growers as many price concessions and rebates as its competitors were getting through other channels, decided to put its own buyer in the Valley and enter the shipping business. To facilitate the necessary rearrangement of its representation of the Prairies, the Associated made a deal whereby from April 1, 1931, to March 1, 1933, the Canadian Fruit Distributors took over the entire management and operation of the C. H. Robinson Company. The division of profits was based on the percentage of support forthcoming from the Nash wholesale houses, and the arrangement was discontinued whereby 75 percent of the profits were distributed to the wholesalers. In 1932, the Nash houses were absorbed by the Western Grocers, Limited, and the consequent decrease in support to the combined Canadian Fruit Distributors and C. H. Robinson brokerage concern resulted in a separation of the company in 1933, with the agreement that each take over the operation of houses in three different centers. The policy of rebates was eliminated and each company is to retain the profits from the offices which it operates. Until this time a buyer's market has existed on the Prairies through the struggle of the large shippers to establish connections with the limited number of string brokerage and jobbing houses.

F. M. Clement, dean of the Faculty of Agriculture at the University of British Columbia, who made an inquiry into the position of six local packing houses of the Associated Growers in 1933, warned Okanagan fruitmen that there was "no place for a buying broker or agent in the Valley if he is to be controlled by a distributing company."[24] He found:

[24] *Ibid.*

> The evidence was all for grower control of the produce until it reaches the jobbing house. . . . Should the situation ever develop where the growers' interest in the fruit ends before it reaches the broker at destination, there is a possibility of complete domination by large, well-organized business groups with large capital. Already this domination seems to have taken hold in the Valley in an insidious way. A united front on the part of the growers is essential if they are to maintain financial independence.[25]

Seizing the opportunity when the interest in the "cent-a-pound" campaign was at fever pitch, the growers and their representatives on the Okanagan Stabilization Board brought so much pressure to bear upon the broker who had opened an office in the Valley that he returned to the Prairies. This incident was later found by Mr. Justice Murphy to have been an action by pool members which was "tainted with illegality."

Judge Murphy was well aware of the gravity of the situation when he handed down his decision against the Stabilization Board in March 1934. "The mere perusal of the facts bearing on financial returns, will, I think, convince anyone that ruin lies ahead of the growers and that at no distant date, unless some remedy for existing ills can be found and applied."[26] To the fruit grower the future looked black indeed. The latest experiment in compulsory cooperation was illegal, and voluntary cooperation was a fiasco. Ten years after its inception, the Associated Growers controlled only 40 percent of the tonnage of fruit in the Valley.[27]

The only hope for improvement of conditions in the fruit industry seemed to depend on the Dominion Government taking action which would recognize the principle that the will of the majority should govern that of the minority. The British Marketing Act was held up as a model, and there was agitation that the former disabilities placed upon Provincial authorities by the provisions of the British North America Act be removed. Finally, the Natural Products Marketing Act was introduced in the Dominion House of Commons, and the Provincial Parliament immediately passed enabling legislation so that there should be no delay in the commencement of its operation in British Columbia.

[25] *Ibid.*

[26] Vernon (B. C.) *News*, Mar. 22, 1934.

[27] F. M. Clement, in the *Report on the Enquiry Conducted on Behalf of the Six Locals of the Associated Growers*, 1.

The Act, passed on July 3, provided for the creation of a Dominion marketing board to regulate the marketing of any natural product which the Government by order-in-council might declare to be a regulated product. Local boards dealing with one commodity were established, and the Provincial Governments also set up boards to supervise and make recommendations to the local boards. The Dominion Government was given power to investigate price spreads, trade practices, etc., and to regulate and control the operations of brokers, wholesalers, and other middlemen. This inquisitorial provision, as well as penalizing power, should provide ample checks to dishonest tendencies. Market control will be assured by control of interprovincial trade, restriction of imports likely to compete with regulated products, and the regulation of exports. Organized producers will then be protected against exploitation by middlemen, foreign competition, and gluts on the domestic market. Should any of these aims be attained, the bargaining power of the grower will be greatly increased, and the time will have come when the Okanagan fruit grower has a recognized position as a factor in the orderly marketing of farm produce. Complete grower-control of the new local board was demanded, and the hope expressed that the Dominion board would function in such a manner that there would be increased consumption by improved methods of distribution, reduction of the spread between producer and consumer, and the opening of new markets, especially in the Orient. The transcending purpose was to obtain for the farmer the cost of production and a reasonable and fair return for his labor and investment.

The Marketing Bill had a stormy passage through the House of Commons. The ranks of the Liberal Party were practically unbroken in opposition to an act, the parents of which they stated were the fruit growers and milk producers of British Columbia.[28] Compulsion of the middleman by the farmer was deprecated as well as the enhancement of the price paid by the consumer. Protests were raised against the infringement of

[28] Speech of the Hon. W. R. Motherwell, former Minister of Agriculture, May 9, 1934, reported in the Vancouver (B. C.), *Daily Province*, May 9, 1934.

the British North America Act, Provincial rights, and personal liberties. And in addition, the specter of monopoly was conjured up. On the other hand, enthusiasts declared:

> Canada at last is adopting marketing legislation in line with the needs of the times and in line with the legislation in force in a score or more of countries, including practically all the Dominions of the Empire. Canada, too, is recognising the desirability of having the Dominion and the provinces pull together for the good of Canadian industry as a whole.[29]

Needless to say, the Okanagan Valley hoped that this was not another mirage. Meanwhile, it was encouraging to note that, practically without exception, independents and cooperatives alike gave the bill their ardent support. The grower-shipper was more guarded in his endorsement, since from lessons learned in the past, he hesitated to intrust the packing and selling of his fruit to any supervising body.

These, then, are the conditions which prevail in the Okanagan fruit industry today, an industry whose annual value is five million dollars. The Okanagan Valley, one of the most highly specialized agricultural districts in the Dominion, has helped to raise Canada to third place in world production of apples. But in elevating her to this position, the Valley has saddled the country with an immense surplus of fruit for which an outlet must be found, either at home or abroad. By whatever means this is done, it must be based on sound economic principles, which when put into practice will afford the grower a livelihood. Until that is done, the final instalment of the history of the fruit industry in the Okanagan Valley can not be written.

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[29] "The Marketing Bill," editorial in the Vancouver (B. C.), *Daily Province*, May 3, 1934.

DOCUMENTS

Pehr Kalm's Description of Maize, How It Is Planted and Cultivated in North America, together with the Many Uses of This Crop Plant

Among the most important sources for the history of American colonial agriculture are the accounts left by the few visitors who were trained scientists. Among these records is an obscure article by the celebrated botanist, Pehr Kalm, which is here translated from the Swedish for the first time.[1] It appeared in two parts under the title, "Beskrifning om Mays, Huru den planteras och skötes i Norra America, samt om denna Sådes-artens mångfaldiga nytta" (Description of maize, how it is planted and cultivated in North America, together with the many uses of this crop plant), in the *Kongl. Svenska Vetenskaps Academiens Handlingar*, 12:305–318 (1751); 13:24–43 (1752). As a statement of agricultural practices in the cultivation of corn the article is considered one of the most complete as well as one of the earliest. Kalm was extremely enthusiastic about the possibilities of maize as an economic crop because it could be used so advantageously by both man and beast.

Although most students of botany know of Pehr Kalm, there is no readily available biography of him in English.[2] He was born in

[1] The translator gratefully acknowledges the assistance of Dr. Conway Zirkle under whose guidance the translation was undertaken and of Dr. Rodney H. True in facilitating its publication. She is also indebted to Dr. A. J. Uppvall and Mr. and Mrs. John B. Dale for advice and assistance. Charles Darwin referred to a manuscript translation of this article in his *Variation of Animals and Plants under Domestication*, 1:340 (New York, 1897).

[2] A. B. Benson, "Pehr Kalm's Journey to North America," in the *American-Scandinavian Review*, 10:350–355 (June 1922); H. O. Juel, "Early Investigations of North American Flora, with Special Reference to Linnaeus and Kalm," in the *Svenska Linné-Sällskapets Arsskrift*, 3:61–79 (1920), and "A Revision of Kalm's Herbarium in Upsala," in *ibid.*, 4:16–23 (1921); H. O. Juel and J. W. Harshberger, "New Light on the Collection of North American Plants Made by Peter Kalm,"

Ångermanland, Sweden, in March 1716. His father, Gabriel Kalm, was the pastor of "Korsnäs Kapell," and his mother was Catharina Ross. Kalm's early education, said to have been completed with great difficulty, was received at Vaasa. In 1735 he became a student at the University of Åbo, where he planned to study theology. Professor Johan Brovallius, impressed with Kalm's interest in the natural sciences, recommended him to Baron Sten Carl Bjelke, who proved a generous patron. In 1740 Kalm traveled through southern Finland at the Baron's expense. The following year, while traveling in central Sweden, he became acquainted with Linnaeus, who persuaded him to enter the University of Uppsala where he soon won recognition as one of its outstanding students.[3] He became a member of the Swedish Royal Academy in 1745, and the following year he was appointed lecturer in natural history and economics at the University of Åbo, although he did not have his doctorate at the time. Promotion to a professorship of economics in 1747 made him the leader of students of natural science and economics in Finland.

Incident to the development of the economic aspects of the natural sciences, Kalm communicated with Linnaeus. Through their combined efforts the funds necessary for a journey in North America were obtained, contributions being made by the Swedish Royal Academy and the universities of Åbo and Uppsala. While in England on his way to America, Kalm met Peter Collinson whose "arboretum" at Pecham included a large collection of American plants in cultivation. Collinson was gardener to the King and had many correspondents in the Colonies. Kalm's

in the Academy of Natural Sciences of Phiadelphia *Proceedings* (1929) 81:297–303; T. O. B. N. Krok, *Bibliotheca Botanica Sulcana ab Antiquissimis Temporibus ad Finem Anni MCMXVIII*, p. 337–339 (Uppsala, 1925); P. A. Rydberg, "Scandinavians Who Have Contributed to the Knowledge of the Flora of North America," in the *Augustana Library Publications*, no. 6, p. 10–13 (Rock Island, Ill., 1907); Spencer Trotter, "Notes on the Ornithological Observations of Peter Kalm," in *Auk*, 20:249–262 (July 1903), and "Peter Kalm's 'Travels'," in the *Popular Science Monthly*, 71:413–419 (November 1907); J. E. Wikström, *Conspectus Litteraturae Botanicae in Suecia ab Antiquissimis Temporibus Usque ad Finem Anni 1831*, p. 113–114 (Holmiae, 1831).

[3] J. M. Hulth, "Kalm som student i Uppsala och lärjunge till Linné Åren 1741–1747," in the *Svenska Linné-Sällskapets Årsskrift*, 7:39–49 (1924).

letter of introduction to Benjamin Franklin, presented on his arrival at Philadelphia, reads:

> To Ben. Franklin, Philadelphia.
> London, June 14, 1748.
>
> Friend Franklin:
>
> The bearer, Mr. Kalm, is an ingenious man, and comes over on purpose to improve himself in all rational inquiries. He is a Swede per nation; and is, as I am informed, employed by the Academy of Upsal to make observations on the pts of the world. I recommend him to thy favour and notice. By him I send the first volume of the Voyage to Discover Northwest Passage. I hope the pacquet, &c., sent under the care of Hunt and Greenleaf is come safe to hand.
>
> I am thy sincere friend,
> P. Collinson.[4]

Kalm fully appreciated the helpfulness of this kind of letter; in his journal, under the entry of September 15, 1748, he said:

> Letters of recommendation are both useful and necessary for one who travels in a strange country. Through letters he soon becomes known, loved and believed. How can one establish confidence with those one has never before seen or heard of? . . . Mr. Benj. Franklin, to whom Pennsylvania is so highly indebted for its development and well being and to whom the scientific world is indebted for many new discoveries in electricity, was the first to introduce me. He gave me all necessary information and showed me many favours.[5]

Kalm arrived in America on September 15, 1748, and remained until February 18, 1751. In October 1748, he made a short trip to New York. From September until June he traveled in the vicinity of Philadelphia, but spent the greater part of his time at Racoon, a Swedish village in New Jersey. It is no longer in existence, but there is a creek with that name in the vicinity. During these months Kalm became acquainted with John Bartram, the most prominent American naturalist of that time, who gave him much information and advice.

In Canada Kalm was received as the guest of the French Government, the officials having been instructed to help him in every possible way in return for the hospitality of the Swedish king to certain French scientists who had visited Sweden. In

[4] William Darlington, *Memorials of John Bartram and Humphry Marshall*, 368 (Philadelphia, 1849).

[5] The quotation is translated from *Resa Till Norra America*, 118 (Helsingfors, 1910). It is on p. 168 in the original edition.

1750 Kalm explored western Pennsylvania and penetrated northward to Niagara Falls where he visited Fort Niagara and the Iroquois. On his return to Philadelphia in October he married Anna Margareta Sjöman, the widow of Johan Sandin.[6]

Kalm's initial interest on his return to Sweden in May 1751 was the distribution of seeds for experimental cultivation. He also prepared several agricultural articles for the *Proceedings* of the Swedish Royal Academy, in addition to the one here translated. In 1753, he began the publication of his famous journal, *En Resa Til Norra America* (Stockholm, 1753–1761. 3v.), which was later translated into Dutch, English, German, and in part, into French. Kalm finally returned to Finland, where he spent the rest of his life at the University of Åbo as professor of economics. He put the arboretum in order and experimented with the culture of American plants. His *Flora Fennica*, published in 1765, is a product of his mastery of the flora of his adopted country. He died at Åbo on November 16, 1779.

Kalm's travels in North America were of the utmost scientific importance. Although he can not be considered a geographical explorer, he was one of the first Europeans to study and collect the plants of this region.

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[Part 1]

From time immemorial, long before the Europeans discovered America, the Americans, not only in North America, but also in all parts of the West Indies, Peru, Mexico, the Continent, etc., planted maize and used it as their food.

Maize is also called *Turkiskt Hvete* in Swedish. Herbalists refer to the plant as *Zea*. For names used by other botanists one may consult Archiater Linnaeus, *Hort*[*us*] *Ups*[*aliensis*], 281, [and his] *Hort*[*us*] *Cliff*[*ortianus*], 437. The Swedes and Dutch in America call the plant *Mays* and *Magis*; the French, *Blé d'Inde*; the English, *Indian Corn*; the Iroquois, *Ohnasta*; the New England savages, *Ewáchim-neash*; and the savages who formerly occupied New Sweden, but who are now completely and entirely exterminated, *Jaéskung*.

Although maize was not known in the so-called Old World, i.e., Europe,

[6] The story of Kalm's marriage is pleasingly told by Rebecca Harding Davis, "An Old-Time Love Story," in the *Century Magazine*, 77:219–221 (December 1908).

Asia, and Africa, until after Columbus discovered America and the Europeans introduced the plant for cultivation, it may now be said to be cultivated in all parts of the world. Some people wish to maintain that the *Triticum Bactrianum* of Pliny, or perhaps his *Milium indicum*,[7] which were introduced into Italy during the time of Nero and described in *Plinii [Secundi] Nat[uralis] Hist[oriae]*, Book 18, ch. 7, was maize. Other authorities have definitely disproved the idea that the plants described by Pliny are maize, and shown that it cannot be the same, but that it is the African wheat or *Holcus Linnaei*.[8]

It is equally significant that the American savages had neither cultivated nor were familiar with the common food crops, such as wheat, rye, barley, oats, and rice, until these were brought to America by the Europeans. Even today it would be extraordinary to see a savage plant any of these enumerated crops. Although he would just as soon eat wheat bread as a European, he prefers to continue to cultivate maize.

It is difficult to say where the Americans first obtained maize. For that matter we are still in the dark as to how man first obtained our own common cultivated crops—wheat, rye, and barley—and where they may now be found growing wild. Of all the travelers who have written of America and of those with whom I am acquainted, there is not one who mentions having found maize growing wild in any part of that Continent. I asked the French in Canada, who have traveled nearly all over North America from Mexico to Hudson Bay, if they had found maize growing wild at any place. They all answered "no." It is possible for maize to replant itself in a field where it has been growing, but such replanting is also common with our cultivated plants. I also received the same answer from the savages questioned. When I asked the savages where they thought their forefathers had first obtained maize, they gave me various answers based on folklore, which were both fabulous and amusing. I must be permitted to include one of these stories, which I may take up later in my journal.

According to the legends of some savages, especially those of New England, a crow brought the first bean, and a maize thief the first kernel of corn. For this reason these birds are considered sacred. The savages never kill them, although they often do much damage to their corn lands. The maize thief, which is described and fairly well illustrated in natural colors in Mr. [Mark] Catesby's *Natural History of Carolina*, 1:12, plate 12 [(London, 1731–43)], is a species of dark-blue starling, or, to be more exact, a bird having characters intermediate between the starling and jackdaw.

Although there is only one species of maize, there are several varieties, due solely to climatic and soil conditions. These varieties are divided into two types, namely, the large and the small. The large variety has no special name, but is simply designated as maize. The small variety is called three-month maize, because it usually matures in that time or less. Occasionally it only

[7] Sorghum

[8] Sorghum.

takes ten weeks. The large variety often takes all of six months to ripen. The large variety, especially in Carolina and farther south, often becomes 18 feet tall. The smaller variety, in contrast, is usually not over 3 or 4 feet tall. One does not see a sign of either male or female flowers on the former when the small variety is in bloom. The large variety diminishes in height as one goes farther north and finally appears to lose itself in the smaller.

Later there develops a difference in color, although most ears are usually provided with yellow kernels; others are of white, transparent, blue, brown, red, mottled, or red and white striped kernels. The farther south one goes the more kinds of maize one finds. The colors are more numerous, beautiful, and showy. The condition is quite the reverse in the north in Canada, where one hardly sees any maize other than white, light, or occasionally blue. The small variety does not produce so many colors as the large. At times some of the kernels on one ear are yellow, while others on the same ear are red. This is brought about by planting. It is to be noted that if yellow and red maize are planted close beside each other the ears which grow on them have a mixture of red and yellow kernels.[9] This mixture is due to the fact that the wind blows the pollen from one to the other at the time of blooming. One might also get a mixture if the three-month maize were planted beside the tall, although the three-month maize usually blooms before the other. He who wishes to keep maize unchanged must be careful not to plant different types of maize next to each other.

In the recent issue of *Act[a Societatis Regiae Scientiarum] Upsal[iensis* (1744–50) 5:47–82 (Stockholmiae, 1751)], where Dr. [Cadwallader] Colden lists all varieties of maize to be found in the English colonies, he even gives one, p. 77, which he calls *Zea semine nudo*, a species which does not have the hard membrane, common to all other varieties, covering the kernels.[10] When I was with him in the summer of 1750 he explained to me that he had been deceived. The maize which he had received had previously had the hard outer membrane removed with lye. As he did not realize this, he planted the kernels. He waited in vain for them to sprout, but they never came up. Later he learned the truth. The method and purpose for removing the hulls with lye will be discussed later.

Climate and water have a remarkable effect on maize. The maize which grows in Virginia at 37° latitude is one and the same as that which grows in New England at 43° and 44° latitude. Maize obtained from Virginia and planted in New England at first ripens with great difficulty and, unless the summer is unusually long, it does not ripen at all. But if one is careful with the

[9] This crossing of color varieties had been described previously by Cotton Mather (1716–1721), Paul Dudley (1724), and Benjamin Cooke (1749). It is, however, one of the earliest records of plant hybridization.

[10] Cadwallader Colden (1688–1776), one of the leading scientists of the English colonies in America, was lieutenant governor of New York from 1761 until his death.

maize in the beginning and succeeds in getting it to ripen, it matures earlier and earlier, so that after several years it ripens as early as that native to the region. The same is true if one takes corn from New England to Canada, which lies at 45°, 46°, and 47° latitude.

Maize is now planted by both Europeans and savages, but much more by the former than by the latter, because savages live by the chase the greater part of the year. When traveling in America one sees miles of nothing but maize fields. The inhabitants have developed a large trade in this grain, for a large quantity is shipped to Portugal as well as to South America, in addition to the amount consumed at home. From a number of the Philadelphia *Gazetteer* I learned that 1,300 tierce,[11] i.e., 10,464 bushels of maize, were shipped from Philadelphia, from March 1734 to the same month in 1735. In Philadelphia, the price of maize per bushel has been as follows: 1719,—1s. 6 to 8d.; 1749,—2s. 7d.; and in October 1750, 3s. in Pennsylvania money, which in sterling is at the ratio of about 100 to 170.

In Carolina, Virginia, Maryland, Pennsylvania, New Jersey, and in the greater part of New York, the inhabitants use the large maize. The smaller, or three-month maize, is planted in New England and Canada, although some large maize is grown. Most of the wealthy colonists, as well as the farmers, plant a small amount of the three-month maize, as it ripens long before the other. It is used in part for roasting and in part for cooking, while the kernels are still soft and not entirely ripe, and is considered a delicacy. I will discuss this at greater length later. In Pennsylvania the small maize ripens six weeks earlier than the large. The savages make considerable use of this three-month maize. The Swedes in America informed me that they had formerly used the three-month maize a great deal, but now it has almost entirely been replaced by the large. The reasons they gave were as follows:

The large maize produces more grain and straw; the ears are larger and more numerous; the stalks are taller and produce many more leaves, which are more desirable for fodder for all kinds of cattle. It is to be noted that the meadows are still very poor, as no native grass or plants are found in North America suitable for meadow cultivation. All such plants must be introduced from Europe. It is true that the smaller or three-month maize is not as productive as the large. The small maize, which does not require as much space between the hills as the large, produces in the end almost as many bushels per acre as the large. The three-month maize is used by some people because it produces flour of a finer, whiter grade than the large.

Now I will relate how maize is planted and cultivated in North America:

The best soil for maize is sandy loam. Maize prefers a light soil and does not do well in clay soils. When the ears of maize growing on sandy soil are about to ripen, the maize on clay has scarcely produced ears, and the kernels of these clay-grown ears when mature are of a pale dead color.

[11] An old measure usually equivalent to 42 gallons.

In a number of places in America I have seen fine maize growing on poor, dry, sandy soil, where one would expect nothing to grow because of the extreme drought and thinness of the soil. The stalks are 4 yards or more tall and very leafy. Each stalk produced one to four large ears well covered with kernels. Such poor soil could never be put to better use. If maize were not available for planting, the inhabitants would find it difficult to live in New Jersey, North America, where the soil is practically all sand. Although rye is produced in some places, neither wheat nor barley will grow in such poor, dry soil. The maize is luxurious where the wheat and rye have withered away. At least maize stands more drought than any other cultivated plant.

If maize is planted in soil which is too rich, it produces mostly stalks and leaves, with very few ears and kernels, and ripens very late. Those who wish to have maize ripen early should not plant it in too rich soil.

Maize is usually plowed in this fashion: In the spring the fields which are to be planted with maize lie unplowed. They are then plowed up in the following manner: The ground is not all cut up. Instead here and there a strip of two or three furrows is plowed, leaving an equal distance between the plowed strips. The distance between the rows of maize should be about 2 to 3 yards for large maize and half that distance for the small type. Later, one plows across these furrows at regular intervals, so the maize may be arranged in quadrates, 2 to 3 yards square for the large maize and half that size for the smaller kind. These quadrates are marked out by driving across the plowed-up furrows at right angles with the plow-point, thus making a small line across each furrow, in order to indicate where the maize is to be planted. In this way the space between the rows is left unplowed, and one's work is believed to be lightened by half. Several days later, after planting, when one is not so busy, the strips between the maize may be plowed and thus plowing is completed. This form of cultivation is possible where there are few weeds. It is the type of plowing most commonly used for maize. The most successful farmers plow the entire field evenly at one time in the spring. Later, furrows about 4 to 6 feet apart are plowed the length of the field. Afterwards furrows are made across the field in the same manner; that is, 4 to 6 feet between each furrow for the large type and half that distance for the small type. At the place the furrows cross, the maize is later planted.

Some people manure the field before planting, others do not, according to the condition of the soil. Manuring does much good if rainy weather follows immediately after planting. If drought follows it is considered to be harmful, and the maize which was not manured grows faster than that which was. If the soil is poor, it is convenient to fertilize it in this fashion: A little manure is placed in each maize hill and one need not manure the soil between the hills and the maize still grows to be quite tall. In New York a type of herring can be obtained. The farmers of that region place one or two of these fish, which make an excellent type of fertilizer, in each hill.

The planting time for maize in North America is commonly at the end of

April, but more often the first of May, or about the time when barley and oats are planted. Some people plant maize as late as the middle of the month of May, but not many. One commonly begins to plant maize in the spring, when one feels certain that there will be no more heavy night frosts.

In South America maize is said to be planted and becomes ripe twice during the summer. The maize which is planted early in the spring ripens at midsummer or a little later and, if the same maize is planted again, it ripens in the fall. The farmers are not so fortunate in North America; the maize planted there in the spring does not ripen until fall.

This cultivated grain has a great advantage in that the shoots can freeze during the spring and will revive. At Albany and other localities there have been examples of this reviving. Occasionally in the spring the shoots have frozen to the ground several times. In spite of this, they have not only grown up from the same roots, but also produced a splendid stand.

Maize is also to be recommended because it can stand much more drought than wheat, rye, or any other cultivated grain. Maize when ripe is not likely to be injured by a long, wet spell, as are other cultivated grains.

Boys and girls from six to fourteen years of age are commonly employed in the planting and cultivating of maize. They can well carry out this business, provided there is an older person to supervise them.

At the intersection of the furrows four or five kernels of maize are planted, partly because one does not know if all the kernels are good and will sprout, and partly because one fears that the crows and maize thieves, as well as squirrels, will pick up some of the planted kernels. If all of these kernels sprout, they still all have room to grow, as the maize is planted so far apart. Therefore, one usually sees that each hill produces three to four stalks.

One or two weeks after the savages or Iroquois have planted the maize, they plant beans in the same place. The maize thus serves as a prop on which the beans can lean and twine. The Europeans allow the maize to stand alone. The savages even plant sunflowers with the maize to use as food.

In order to prevent crows, maize thieves, and squirrels from scratching and picking up the newly planted maize, the following procedure is used: The root of *Veratrum Linn. hort. Cliff 468*, which is *Helleborus albus J. B.*,[12] grows in quantities in swamps and small streams. This root is cooked in water and the water allowed to cool. The maize which is to be sowed is put into the water in the evening and allowed to stand and soak until morning. The kernels which have been soaked are then planted. The squirrels, maize thieves, crows, and other animals destructive to maize, who pick up the planted kernels, become so dizzy from one or two kernels that they tumble over and frighten the others, who no longer venture to return. One should be careful to see that maize thus treated is not eaten by any domestic animal, or it will flee for its life. If chickens or ducks get just one kernel of this corn, they become quite sick. Maize thus

[12] *Veratrum viride* Ait.

treated is not injured in any way if it is planted immediately. The maize plants grown from treated maize-kernels do not develop any injurious qualities.

The kernels are planted 2 or 3 fingers'-breadth deep. Experience has shown that the kernels grow better if they are barely placed below the surface, but one is forced to plant deeper to prevent crows and other pests from too easily reaching the kernels. In planting, some farmers drop all the kernels into a hole made with a garden hoe and allow them to lie on top of each other as they fall. However, it is considered better practice to make four or five holes beside each other in the ground and to place one kernel in each hole. As soon as the kernels are placed in the ground they are covered by hand or hoe with dirt 2 or 3 fingers'-breadth in depth.

The most successful husbandmen observe the following rules in the planting of maize: First, they must select the largest and ripest ears for seed to plant the following spring. If the kernels which are not entirely ripe are planted they cannot survive a long, rainy season, but mould and rot. Secondly, the kernels are soaked before they are planted. Soaking causes them to come up several days sooner. Thirdly, the kernels are planted 6 inches, deep enough so that maize thieves and other pests do not reach them. It is believed by some people that the kernels can be planted even deeper and still come up as long as they are not covered with stones or turf.

When the maize is about 6 inches tall it is plowed to destroy the weeds, and at the same time the soil is raked or moved up to the stalks. The plow is the same as that used for all other crops. A team of horses hitched side by side is often used in pulling the plow. A special type of small plow pulled by one horse is used for plowing between the stalks. In plowing, the soil is turned toward the stalks and made into hills. This process is repeated later during the summer. If, for example, one plows between the rows from south to north, or on the east or west side of the row, one banks the soil later with the hoe from south to north. The next time one plows directly over the first and turns the soil directly over the first, and turns the soil in the opposite direction from east to the west side of the row.

Some people do not plant the maize in such widely separated rows, but instead plant them scarcely a yard apart. It is then impossible to cultivate between the rows with horse and plow. Instead the soil is moved to the stalks with a garden hoe. The hills around the maize finally become about a foot high and 2 feet broad at the base and in each hill there are usually three to four stalks. . . .

[Part 2]

Maize is a food plant, which, more than all others, needs to be kept free from weeds. In former times the weeds were removed from between the rows with hoes, but now they are removed by plows, as I have previously described. Some people cultivate maize with the harrow, and this method should have approxi-

mately the same result. During wet weather far more plowing is necessary than during dry weather, as more weeds grow at that time. When the plant has almost reached its full height, it sends out numerous offsets or stalks, which the Swedes who live in America call *Sugare*. These *Sugares* absorb much sap from the plant, and as they are useless, they should be torn off. They are removed by being forcibly pulled from the stalk. The removal of the *Sugares* promotes earlier ripening of the grain. As soon as the grains begin to harden in the ear, one can cut off the tassels or male flowers, which are then withered. These tassels are desirable food for horses and cattle. If the tassels are cut off, however, when the kernels are still in the milk, i.e., before they begin to harden, the ears generally dry up and do not ripen.

When the maize is nearly ripe, some people usually go out into the fields and pull back the stiff, hard leaves, which surround and cover the ear, in order to see how far it has advanced. The more intelligent farmers, however, avoid this untimely curiosity, because the exposed ears soon attract maize thieves.

In the northern part of the country the maize ripens during the latter part of August; farther south it ripens from the middle to the end of September; and in the other places it does not ripen until the middle or end of October. The ripe ears are taken from the fields; for this process no knife or sharp implement is needed; one merely takes hold of the ear or the husk which contains it, and pulls on it a little, bending downward; both the ear and the husk loosen immediately. Some take the trouble to separate the husks from the ears in the field; others carry the ears home and then separate them. When the ears have been picked, if the weather conditions permit, they are allowed to lie a day or more in the sunshine under the open sky to dry out a little before they are stored; but if they have stood in the field long enough to be quite dry, they can be stored immediately, without any further airing or drying. It is safer, however, to allow them to lie for a time, provided the weather permits.

Various methods are used in preserving maize when it is ready for storage. In the English colonies the maize is stored in small houses especially built for this purpose. These houses, similar to our hay sheds, are constructed of small slats. The structure is open in order that the air may pass through freely to keep the ears dry. The length of these houses is approximately 3 fathoms, the width scarcely 2 to 3 feet. If the shed is too wide, the results are likely to be disastrous, since the air cannot circulate freely, except in the case of ears which lie near the outside. The height of the shed depends entirely on the amount of maize. Under the maize the floor is of the same open construction. Above, the shed is covered with boards or other material. It is usually built at a distance from the other buildings, in order that the air may circulate more freely on all sides. Often both rain and snow whirl in, but the maize is not injured by it, as the air dries it immediately. Another difficulty in storing corn is to be found in the necessity of coping with rats and mice, which have easy access to these maize storehouses. Some people hang the ears up in large lofts or spread them out and leave them to dry, allowing the air to blow in. This practice seems to

be better than the first. It has been shown by long experience that when the maize is preserved on the ear, as described, it can be kept for many years and still be good for planting.

The savages allow their maize ears to dry in a moderate smoke, and afterward hang them up under the ceiling in their huts. The ears remain good for many years, both for food and planting. At the time of the arrival of the Swedes in North America, savages lived all over the territory called New Sweden. They used to preserve their maize for several years in this fashion: They dug a deep pit in the ground in a dry place, covered the bottom and walls, or sides, with dry bark, and put dry grass on the bark at the bottom. Then they placed the maize in the pit. They also put dry grass at the sides next to the bark and then covered the top with soil. The grass, *Lagurus spicis oblongis pedunculatis e singula ala pluribus, Linn. Hort. Cl. 25*,[13] which they utilized, is even today called savage grass by the Swedes in America. The same method of preserving maize is still utilized by savages in a number of places in North America. A savage during war time generally has several such pits. In case the enemy should raze one the others would remain secure and undisturbed. Even when he goes away during peace times with his whole family on a hunt which often lasts for half a year, he preserves the maize at home in similar pits. Wide experience has taught him that maize in this condition remains fresh and unimpaired for many years.

Now I will come to the uses of maize, which are so numerous. I doubt if any other species of grain exists which alone may be used for so many purposes both for man and animals.

To begin with, it is one of the most productive plants in the whole world, wherefore it is called by some "the lazy man's crop." I have counted on a single ear 650 clean and healthy kernels, and on each stalk commonly two to three ears. An ear is rarely found which has less than 300 kernels. In addition, this crop has this advantage—the kernels do not spill away as in the case of rye and other grains. On the contrary, great difficulty is apt to be encountered in loosening the kernels. In America this crop is considered a failure if it does not yield two hundred times the corn planted. It is to be noted that a large household seldom plants over 2 bushels,[14] in fact, rarely this much in order to raise food for an entire year, and in addition, some for other purposes.

Let us recall what has previously been discussed: Maize can freeze several times during the spring and still come up from the same root; it stands more

[13] "Linnaeus treated the *Lagurus spicis oblongis*, etc., as an *Andropogon* in Species Plantarum 1046 (1756). Since the Linnean conception of species in *Andropogon* was very vague, it is probably not easy to tell exactly which one of the now recognized species or varieties he may have meant, but one can guess offhand that it was probably some variation of *Andropogon scoparius*."—M. L. Fernald in a private communication to the translator.

[14] A bushel is an English measure somewhat less than a "half span." (Pehr Kalm's footnote.)

heat and drought than any other crop plant; it grows in much poorer soil; it grows rapidly in dry and sandy places; it is not subject to injury by excess moisture as other crops, etc.

If the leaves of maize are removed from the stalk while they are still green, i.e., before they have dried by themselves in the sun, and put together in a covered stack, they will provide food for horses and cows, which is preferable to clover or other good hay. On the other hand, if the leaves dry by themselves out on the stalks, the horses and cattle will not eat them, unless they lack all other food. Warm water poured on maize leaves which are dried green makes a fodder which provides the cows with both food and drink, and increases the amount of milk considerably. During the winter these leaves are cut in pieces, just as we cut straw for provender for horses. Horses prefer this fodder to clover hay. When the maize ears are large, but the kernels on them still soft, it is customary to remove the ears from the stalks on which they are growing in the field. The husks covering the kernels are torn off. The ears are then placed in front of a fire to roast until they become light brown. These ears are considered a delicacy by both Europeans and savages. The savages plague strangers and guests who visit them at that time by offering them roasted ears. If maize had been known to the Israelites, I would say that these ears were the same as the dried ears mentioned in the Bible. But here there is no room for conjecture. Later in the season the savages do not roast the green ears, but cook and eat them, and they actually taste quite good. It is even customary with many to take these green ears where they stand in the field and eat them immediately, raw as they are. I have often done so myself, and to my taste, the kernels are as good as sweet-sugared milk.

While the maize stalks are green, and before the ears are ripe, there is a clear water between the nodes of the stalk, which is as sweet as sugar. Various people have made both syrups and sugar from maize, but this conversion has not been considered profitable. I have seen the Europeans, as well as the American savages, cut off the maize stalks in the field, chew them to pieces between their teeth, and suck out the sweet juice. [John] Lawson, in his *Description* [*i.e., History*] *of Carolina*, p. 75 [(London, 1714)], says that some people crush the stalks and make from them a very palatable drink.

Maize kernels are tightly fastened to the cob (the stalk of the ear). To pick them loose with the fingers would be difficult and rather slow work. The kernels would not come loose by threshing. Therefore, when one needs the maize kernels loose from the ear, either for grinding or for other purposes, one takes a tub or any vessel, puts a long thick hinge or any other piece of iron with an edge directly over the vessel. This piece of iron is bound fast to the vessel at both ends. Against the edge of the iron the side of the ear is placed and thus the kernels are scraped off. They fall down into the tub or vessel. A little technique is required before one can do this easily. Others use a slower method. They loosen the kernels by means of placing the ears in a large wooden mortar and pounding them slowly. Neither the Europeans nor the savages separate

the kernels from the ear before they need them for food or other purposes, as they keep better when attached to the cob.

In most of the English colonies the farmers make their bread from maize. In Maryland even the aristocracy and the wealthy eat hardly any other bread. If a stranger comes to them, they place before him both wheat and maize bread, allowing him the freedom to choose whichever he prefers; they themselves prefer the maize bread. But if the bread is made entirely of maize, one does not find it so good. The best is made of rye and maize flour mixed. From wheat and maize flour one also gets fine bread. In America this bread is commonly baked in the form of large loaves. It is a very wholesome bread and always keeps the bowels well regulated. I know that various people, describers of plants as well as travelers, who have written about maize, have said that too much maize for food causes constipation, and even skin eruptions, scurvy, and itch. This I had read and heard discussed, here at home in Sweden, before I left for America. I had also read those who claim that maize had been unjustly criticized. When I reached America and observed people who ate almost nothing but maize and looked as well and happy as those who eat the best and cleanest rye or wheat bread, I often told them what I had read and heard about maize. At the same time I asked them if it did not cause constipation and skin eruptions. They answered all of one accord that no more wholesome food exists and that they had never had these symptoms which are attributed to maize. I then determined to experiment on myself. Maize was a food which I had scarcely seen, much less tasted. I had just come to a strange climate; it should certainly show its effect on me. I ate, then, during the whole first winter I was in America hardly any other bread, only maize alone or maize and rye flour mixed. However, I had no digestive disturbances, at least not more than usual. I found no such effects as those attributed to maize—quite the opposite. I can never wish to be in better health than I was at that time. The boy, Jungstrom, who accompanied me, reacted similarly. Others who have written of North America attribute to maize the same laxative quality which I found and for that reason they recommend that it be mixed with wheat, to counteract the binding constipating effect of the latter. The results attributed to the use of maize are due either to climate or to some other factor, which man has not carefully investigated.

Occasionally people make bread of different kinds of pumpkin and maize mixed. This bread is very fine and sweet. Usually the maize flour is scalded first and the pumpkins cooked, and then both are kneaded together. When bread is made of rye flour, a mush is first cooked of the maize flour, which must stand until cool, then the rye is kneaded in.

The savages make their maize bread in a different manner. They grind the maize in a large dry wooden mortar to grits or coarse flour, of which I shall speak later. Then they make a dough which they fill either with American blueberries, blackberries or wild grapes, which they collect and dry in great quantities during the summer for this purpose. From this dough small cakes are baked the

size and shape of our blood cakes. These are first cooked in water like dumplings and then roasted and baked on a hot stone, or only cooked in water without the later baking and roasting. They are sometimes wrapped in leaves and blades of herbs and buried in ashes. A fire is built over them and in this manner they are baked. This is a dish especially used for important celebrations and big feasts, when they have some stranger for whom they wish to show their highest respect. Such bread tastes good and is usually eaten while it is warm. When strawberries are ripe, they make bread in the same way from maize and strawberries.

Most mush which is used in America is cooked from maize flour, and although nothing is added except water, it is very white and similar to our mush cooked with milk. To my taste its flavor is more delicious than the mush cooked from any other flour. During the time I spent with the Dutch who live north of Albany, I never had any other food in the evening but maize mush and milk, and scarcely any other breakfast but the same maize mush, either browned in butter or warmed in sweet milk. The Dutch ate nothing else for long periods. During the previous summer, when I was with them, they cooked part mush, part gruel, from maize flour and buttermilk mixed together, which tasted well enough to the hungry stomach. From grits of maize a mush or gruel is made which is cooked with water, buttermilk or sweet milk, and all of these types of gruels or mush almost vie with that cooked of rice. Occasionally syrup or sugar is mixed with the buttermilk to make it more tasty. Maize mush is quite nourishing.

From the American savage the Europeans have learned to make a grit soup of maize, which is generally esteemed as a delicacy. The French call it *Sagamité*; the English and several savage tribes, *Hommony*; the Swedes and some wild tribes, *Sapaan*. It is made in the following manner: As many of the maize kernels are taken out as needed and placed in a vessel. A little water is poured over them, enough to cover the maize. It is allowed to stand for a time, after which the maize swells somewhat. Then this maize is put in a large wooden stump, standing perpendicular and hollowed out at the top. In this wooden mortar the maize is pounded slowly with a wooden pestle, until the hulls loosen and separate from it. After that the hulls are washed away. Only the heart remains, which has been well broken up by the slow crushing, not into flour, but into coarse pieces like coarse grits. These maize grits are placed in a kettle and cooked with water for a time. Later meat is added (for maize grains require longer cooking than the meat); and when it is thoroughly cooked the kettle is lifted from the fire. Maize thus prepared is good food and, according to my taste, has a flavor resembling a soup of grits or peas. When this soup cools, it can be warmed again if desired. If it becomes too thick, sweet milk may be added, which I believe improves the flavor.

For a more convenient method of pounding and preparing this grain, the upper end of the pestle is bound to a pole, which is at the same time fastened to the ceiling, like the pole of a turning lathe. The resilience and elasticity of the

pole manipulates the pestle in such a manner as to cause a slow crushing. Some people remove the hulls in the following manner: They make a lye solution from ashes and soak the maize kernels in it for a short time. The hulls disintegrate and fall off. The maize is then washed several times in clean water in order to remove the taste of lye. The maize kernels thus obtained are entirely whole and not crushed to pieces. They are used in the same manner as *Sagamité*, which was previously described. I have already told how Dr. Colden came to name such hulled maize *Zea semine nudo*.

Some people in America make near beer from maize. They commonly consider blue maize to be better and more productive for this purpose than any other kind of maize. Maize malt is prepared in the same manner as any other malt, but malting takes longer. If much near bear is to be produced the maize should be allowed to sprout until the shoots are quite green. Malting maize should be washed thoroughly once a day in order to prevent moulding. The malt of maize tastes exactly like that of barley. A quantity of blue maize is planted by some people solely for the purpose of making this drink. The ale brewed from maize is not inferior in strength and flavor to that which is brewed from barley. This near beer has a quality which vies with other near beer. A near beer is also made of broken-up maize bread. In addition to the fact that blue maize is considered to be more suitable for making near beer, it has the advantage of ripening in a week or fourteen days. Fine spirits are distilled from maize, although this is a property of less importance.

In Canada most of the inhabitants travel widely in an attempt to buy fur articles for trade. They must seek the distant savage nations. It would be impossible to carry the food necessary for such a long journey, because there are long stretches over land where it is necessary not only to carry boats, but also the articles they are going to sell. They journey two to three years, and are often in places where they would not have access to food. They have therefore discovered a different type of food, which in small quantities can still give a great deal of nourishment, and has in certain cases the same use as the herbs which the Dutch used in former times on their long trips, or the herbs which the Scotch Highlanders use, even today, for the same purpose. For concentrated food, maize is used. It is either baked in hot sand or ashes or in an oven after the bread is removed. When the maize is baked it is put in a wooden mortar such as previously described, pounded to pieces with a wooden pestle until it is like coarse grits. Later it is taken out and the hulls are washed away. After that the finer maize grits are mixed with other material, either sugar from the sugar maple or something else, according to how sweet one prefers it. The sugar and parched corn are well mixed and kept either in a sack or some other kind of container. If a traveler is on a journey and gets hungry, he takes a half or whole handful of this flour mixture, puts it in a shell or another vessel with water, stirs it and thus it is eaten. The maize which is put in ashes to bake is not on the ear, but in loose kernels. The traveler makes a pit in the sand or ashes, covers the kernels with sand or ashes, builds a fire over them, and there

they are baked. The American savages, who do not have ovens, take advantage of this method in preparing this concentrated food. If fat is added, it becomes even more nourishing. Some people take the coarsest part of the ground maize and put it in a sack for themselves and eat it mixed with fat. People of quality mix maize flour or grits with sugar, but this is chiefly a food used by the wealthy on journeys. Those who cannot afford sugar use only maize for a concentrated food. The outer hulls are removed with lye and the grains are dried. These grains are taken on journeys. They are cooked in a pail or kettle; a little fat, such as one can obtain on a journey, is added, either of bear, deer, or something else. Then it becomes a very good food.

This concentrated food, which the savages first invented, is called *Quitzera* by the Iroquois. Captain Buttler, an Englishman, informs me that when he accompanied the English army and the Iroquois in 1710 on an expedition through the wilds to make a conquest of Canada, nearly each and every soldier had some of this concentrated flour with him. A little concentrated flour was placed in the impure water which was to be had in the wilderness. The water was thus improved and they had no ill results. In contrast, those who did not bother to do this were nearly all sick.

Horses like maize quite well. One must be on guard, however. When the maize kernels are still green and in the milk, they are not especially healthful for horses. They claim in America that when the maize is ripe a horse gets as much nourishment from a bushel of maize as from 2 bushels of oats. Yet maize is considered better for a horse which is to be fattened, and oats better for one which is to be ridden on a journey. The kernels of maize are pounded from the ears in a mortar, as previously described. One or two of these mortars are to be found on each farm. The kernels are pounded loose from maize ears especially for journeys so the horses may eat them more quickly. A few whole ears are mixed in for the horses. Although it goes slowly the horse must take the trouble to chew the kernels loose. If a horse gets into a field of maize, when the ears have formed, he leaves the most desirable grass and clover pasture and turns entirely to picking maize ears. This I myself have seen.

Nothing is better for fattening cows and oxen than maize bran and maize flour, which are frequently mixed. Sheep are unbelievably greedy for maize, as I have observed in amazement many times. For swine, maize is considered to be the best fodder, in that it is very fattening and the flavor of the meat is far superior to that produced by any other fodder.

Chickens, doves, ducks, and geese prefer this feed to all others. Chickens also lay better when they are fed maize. In a word, without exception, I know of no cultivated plant which is so universally and greedily sought by all domestic animals.

How delicious this food is to all sorts of animals is to be inferred from this: I hardly know of any cultivated plant which has so many enemies as maize from the time it begins to ripen, and even after it is stored. For example, rats and mice leave wheat, rye and all other foods untouched as long as they have access

to maize in the field or storehouse. Crows also prefer maize to all other types of food. Maize thieves are of three types—the gray and black American squirrels, ground squirrels, or those which live for the most part in the soil and do not climb trees. Woodpeckers of various sorts, and other birds, are so greedy for maize that it is almost impossible to scare them away from the field by any method of frightening or trapping. The birds are present during the day and the squirrels during the night. In a few nights, if undisturbed, squirrels can cart away from the granary half a tub or more to their nests. When the maize is ripe, but still in the fields, I have myself seen a farmer with his gun go to the end of the field and shoot at the maize thieves, who do not allow themselves to be frightened from the delicious maize. Finally, the whole swarm of them move forward from one end of the field to the other. When the farmer returns, they fly back to the part of the field where they were before, and so they switch from one end of the field to the other, entirely according to how the farmer pursues them. They almost wear the farmer out before he is able to scare them away, although now and then he shoots one of them. In order to rid the maize of all these destructive pests, the governing bodies in all parts of that country have been called upon to set a definite bounty to be paid on squirrels, crows, maize thieves, woodpeckers, and other pests. An almost inconceivable sum was paid in Pennsylvania alone for squirrel heads for a single year, namely, from January 1, 1749, to that same date, 1750. When the representatives from all regions in Pennsylvania met at the beginning of 1750 to make necessary laws, they received complaints from all regions that the treasuries were empty solely because of squirrels. Previously a law had been enacted that 3d. (which is about 12 to 14 öre kopp:mt) should be paid from the general coffers for each squirrel head. So high had the spirit of vengeance gone against these animals, that during the one year £8000 in Pennsylvania currency had been paid. This is 40,000 plåtar in our money. When I heard this discussed above all else in the city, it was inconceivable to me until Mr. Franklin, who has gone so far in experiments with electricity, and who is one of their outstanding legislators, convinced me of the truth directly from the documents. The high expenditure was attributed to the fact that when one received 3d. for each squirrel it paid to go into the woods to hunt these creatures. Many young people in particular gave up all other work and went to the woods to shoot squirrels. The legislature was therefore forced to repeal the law and change it from 3d. bounty to half that sum for a head.

A very similar law was passed against maize thieves in New England. As a result, the maize thieves were almost wholly and entirely exterminated. During the summer of 1749, a multitude of grass worms spread over the entire country, destroying all the hay crop for that year. The inhabitants were forced to write to England for a ship loaded with hay. They began to regret that they had been so hard on the maize thieves because they believed, as they had previously observed, that the maize thieves for a good deal of the summer before the maize ripened, lived on these insects and thus hindered their increase. The

people of New England were conscience-stricken because they believed this to be a punishment for meddling in the providence of the Almighty Creator.

For swellings the following is used: A mush of maize meal and milk is cooked. While the mush is on the fire suet or other fats are added. The mush is spread on a cloth and is placed on the swollen part as hot as one can stand it. It should remain until cold. This is held to be an unequalled aid in the treatment of swellings, for it relieves the ache, brings down the swelling, or ripens the swelling, if it is a boil, so the pus drains out. I have tried both. With my own eyes I have seen others obtain relief by using this treatment for swellings caused by toothache or colds.

Thus, I have described what I was able to observe during my trip to America, in part the cultivation of corn, in part its manifold uses. I have also described how its ripening depends largely on the climate. Where the summers are long, it does not ripen quickly; quite the reverse in the north where the summers are shorter, it has become accustomed to ripening in three months' time or even less. I think, therefore, that I have the right to believe that it, namely the small type or three-month maize, could ripen here. It must be sown in sandy soils, which it prefers, not in clay. It requires a great deal of sun. Even though it would ripen with difficulty in the beginning, I believe it would adapt itself to our climate. In my brief discussions on the uses and cultivation of the plants which have been brought home from America, I have pointed out how cotton as well as maize has gradually been moved farther and farther north. I now wish to add that even tobacco, which also comes from America, does not always ripen seeds at a latitude of 40° in its native home. Experience has shown us that our tobacco commonly ripens its seed even as far north as Savolaks and Österbotten, although our seed was originally brought to Sweden from a latitude of 37° and 39° in North America. Why then should maize which is able to ripen in North America at a latitude of 48°, where the length of the summer and winter differ in no way from those of Sweden, not reach maturity, and become adapted to ripening in Sweden? I am referring to the small kind. This is the three-month maize, which is not as productive as the larger kind, but gives whiter and better flour. I cannot say whether or not the larger kind would adapt itself to our climate.

He who wishes to know what others write about maize should by all means read [José de] Acost[a], *Hist[oire] Nat[vrelle et Moralle des] Ind[es, tant Orientalles qu'] Occid[entalles]*, Book 4, ch. 16; and [Rembert] Dod[oens], *Frvment[orvm, Legvminvm, Palvstrivm et Aqvatilivm Herbarvm, ac Eorvm, Qvae eò Pertinent,] Hist[oria]*, 73 [(Antverpiae, 1566)]; Kasp[ar] Bauhin, *πίναξ Theatr[i Botanici]*, 25 [(Basileae, 1671), and his] *Theatr[i Botanici]*, 490 [(Basileae, 1658); John] Parkins[on], *Theatr[um Botanicvm: The Theater of Plants]*, 1138 [(London, 1640); John] Ray, *Hist[oria] Plant[arum]*, 1249 [(Londini, 1686–1704); Thomas] Campani[us-Holm, *Kort] Beskr[ifning] om [Provincien] Nya Swerige*, 32 [(Stockholm, 1702); John] Lawson, *Description* [i.e., *History*] *of Carolina*, 75 [(London, 1714); Pierre François Xavier de] Charlevoix, *Hist[oire et Description Generale]*

de la Nouv[elle] France, 6:44[-48 (Paris, 1744); Francisco] Hernández, [Mark] Catesby, [William] Dampier, and others who write about it, as I have described only what I myself observed. In the [*Philsophical*] *Transactions* [of the Royal Society of London, 12:] 1065[–1069 (1683)], a short description of the cultivation and uses of this food plant is also to be found.

PEHR KALM.

December 14, 1750.

NEWS NOTES AND COMMENTS

AGRICULTURAL HISTORY RESEARCH IN PROGRESS

Professor Thomas P. Abernethy of the University of Virginia plans to spend the summer of 1935 completing his study on Virginia's western lands.

Professor Solon J. Buck of the Western Pennsylvania Historical Survey is preparing a study of "The Planting of Civilization in Western Pennsylvania." It includes a consideration of agriculture in the region prior to the War of 1812.

Professor Harry J. Carman's address on "History and Technology," presented at the session on "Dynamics and History" of the American Historical Association at Washington, D. C., Dec. 27, 1934, is printed in the *Social Studies*, 27:152–162 (March 1935).

Mr. R. O. Cummings of Harvard University is collecting material for a history of American diet.

Professor H. E. Erdman of the Giannini Foundation for Agricultural Economics at the University of California is continuing his research on the history of coöperative marketing.

Professor W. Freeman Galpin has recently published a volume on the history of the Delta Upsilon Fraternity, to commemorate the one hundredth anniversary of its foundation, and is now writing an English history text in which he hopes to bring out many social aspects usually left out of such works.

Professor W. H. Haas of the department of geology and geography of Northwestern University is preparing a book on Puerto Rico.

Professor G. W. Hendry of the division of agronomy of the College of Agriculture of the University of California at Berkeley is making a study of crop and weed introduction into the San Francisco Bay region during the Mexican period, 1823–1848, by means of adobe brick analysis of fifty buildings, and also an investigation of the longevity of crop and weed seeds recovered from sun-dried adobe bricks.

Mr. Guy Lee, a graduate student at Harvard University, is making a study of the history of American grain elevators.

Dr. Frederick L. Lewton of the U. S. National Museum is engaged in a study of the types of cotton cultivated in the United States before 1800.

Professor Earle D. Ross of Iowa State College is making a comprehensive study of the history of the land grant college. His article on "The Manual Labor Experiment in the Land Grant College," in the *Mississippi Valley Historical Review*, 21:513–528 (March 1935), is part of the larger study.

Mr. O. J. Scoville is investigating the land and immigration policies of Wisconsin in Professor George S. Wehrwein's seminar on land economics at the University of Wisconsin.

Dr. Addison E. Sheldon's study of "Land Systems and Land Policies in Nebraska" is to appear during the summer as the next publication of the Nebraska State Historical Society. It is a comprehensive discussion of all the aspects of the relations of land to human society within the limits of the State.

Mr. Harry Keith Work, graduate student at Cornell University, is preparing a master's thesis on "The Use and Abuse of Police Power by States to Protect Their Agricultural Production."

ECONOMIC AND SOCIAL PROBLEMS OF THE SOUTHERN APPALACHIANS

A study of the "Economic and Social Problems and Conditions of the Southern Appalachians" by the Bureau of Agricultural Economics, the Bureau of Home Economics, and the Forest Service of the U. S. Department of Agriculture, in cooperation with the Office of Education of the U. S. Department of the Interior, and the agricultural experiment stations of Tennessee, Virginia, West Virginia, and Kentucky has been issued by the U. S. Department of Agriculture as its *Miscellaneous Publication 205* (Washington, U. S. Govt. Print. Off., 1935. 184 p., maps). It includes sections on physical features and conditions; types of land utilization; farm organization and management; markets, transportation, manufactures, and occupations; problems of public finance and farm taxes; schools and education; population distribution and changes; variations in farm-family living; food supply; social conditions and social organizations; and the church situation.

THE JOURNAL OF SOUTHERN HISTORY

The first number of the *Journal of Southern History* appeared in February 1935. It is published quarterly by the Southern Historical Association, organized at Atlanta on November 2, 1934. "The major objective of the Association involves the promotion of interest and research in southern history, the collection and preservation of the South's historical records, and the encouragement of state and local historical societies in that section to vigorous activity. . . . It is to the accomplishment of its major objective that *The Journal of Southern History* is dedicated." The *Journal* is an important landmark in the growing interest in the history of the South, and it promises to be of great value to those interested in agricultural history as so much of the history of the region has been essentially agricultural.

Professor Wendell H. Stephenson of Louisiana State University is managing editor. Dr. Edwin A. Davis of the same university is editorial associate. The following professors constitute the board of editors: Philip M. Hamer of the University of Tennessee, Dwight L. Dumond of the University of Michigan, E. Merton Coulter of the University of Georgia, Fletcher M. Green of Emory University, Thomas P. Abernethy of the University of Virginia, William C. Binkley of Vanderbilt University, Richard H. Shryock of Duke University, and Charles S. Sydnor of the University of Mississippi.

ARTICLES RELATING TO THE HISTORY OF AMERICAN AGRICULTURE

Unclassified: J. E. Boyle, "Our Three Henry Wallaces," *Amer. Mercury*, 34:319–327 (March 1935). E. E. Edwards, "The Need of Historical Materials for Agricultural Research," *Agr. Hist.*, 9:3–11 (January 1935). C. M. G[ates], "Some Sources for Northwest History: Account Books," *Minn. Hist.*, 16:70–75 (March 1935). W. L. G. Joerg, "Geography and National Land Planning," *Geogr. Rev.*, 25:177–208 (April 1935). J. F. Rippy, "Foreign Markets and the

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